ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXIII, No. 26. CHICAGO, SATURDAY, DECEMBER 27, 1913. ISSUED WEEKLY.

COMPRISING

ELECTRICAL REVIEW WESTERN ELECTRICIAN ELECTROCRAFT

ELECTRICAL REVIEW PUBLISHING COMPANY
608 SOUTH DEARBORN STREET
CHICAGO

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SUBSCRIPTIONS.

One Year, United States.....$3.00
One Year, Canada..... 4.00
One Year, Foreign Countries..... 6.00
Single Copy, 10 cents. Back numbers, beyond one month, each .25

Entered as second-class matter, November 7, 1908, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

CONTENTS.

EDITORIALS:
Two Notable Events in Public-Service Developments....1247
The Electric Vehicle for Christmas Deliveries.....1248
Street Lighting on Dark Days.....1248
Diversity-Factor 1249
Meters for Two-Rate Systems 1249
DEPARTMENTS:
Commercial Practice.....1258
Electrical Construction 1261
Dollar Wiring Kinks.....1264
Public Service Commissions.....1265
Questions and Answers.....1266
New Electrical and Mechanical Appliances.....1281
Latest Approved Fittings.....1285
Current Electrical News.....1286
Record of Electrical Patents.....1293
LEADING ARTICLE:
Centralized Control System for the Panama Canal Locks 1251
LETTER TO THE EDITOR:
Cancer and Secondary Rays from Calcium Phosphate.—By Reginald A. Fessenden.....1267
BOOK REVIEWS.....1277
MISCELLANEOUS:
International Electrical Congress.....1250
Central-Station Power for Large Chair Factory.....1258
Spectacular Sign for Commonwealth Edison Company..1259
Two Large Contracts in Pittsburgh.....1260
New Business at Louisville.....1260
Wrought-Iron-Plate Foundation Washers for Electric Machines.—By Gerald D. Thomas.....1261
Reel for Lamp Cord.—By E. M. Raetz.....1261
Stock-Keeping and Buying.....1262
Foreign Markets for Electrical Wiring Supplies and Appliances 1263
Among the Contractors 1263
New England Vehicle Meeting.....1265
The Limiting Size of Steam-Turbine Units.....1268
Electrical Laboratory of the Dresden Technical High School 1269
American Telephone & Telegraph Company Proposes Independent Control and Management of Western Union and Arranges for Extension of Long-Distance Facilities to Independent Companies.....1272
Street Lighting 1274
Further Advances in Wireless Communication with Moving Trains 1275

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TWO NOTABLE EVENTS IN PUBLIC-SERVICE DEVELOPMENTS.

During the past ten days two notable events have taken place. One is in connection with the report of Postmaster-General Burleson concerning the purchase of the telephone and telegraph facilities of the country by the United States Government, and the other is the proposal of the American Telephone & Telegraph Company concerning the future conduct of its business.

Each of these proposals vitally affects every interest of the country. With the former it is hard to find upon the part of anyone cognizant of the history of Government ownership of wire facilities abroad any favorable opinion, and it is sincerely believed that when the great development which has taken place under the able management of the wire chiefs of the country is thoroughly understood that the great mass of the public will be entirely opposed to giving up what has been demonstrated to be a well-nigh perfect system to the hazard of dissolution and possible destruction of efficiency. In discussing the matter of Government ownership of the wire facilities of the country in a recent issue of Hearst's *Chicago Examiner*, an editorial evidently from the pen of the brilliant and always interesting editor, Arthur Brisbane, says "The Government can employ or train another Vail or Bethell." This may be true, but it will be a sorry day for the commercial interests of this country if we are to lose any of the wonderful gain that has been made in development of service and smoothness of operation while other Vails, Bethells and Cartys are in the process of development.

And while we are speaking of the development of men of ability, it may be remarked that except in rare instances the really great constructive talent that has moved the world to practical achievement has been developed not through Governmental opportunity, but because of the rewards for and the appreciation of ability that have been a part of private and unhampered operation. It is not conceivable that the Government would attract in its operation of the telephone and telegraph facilities of the country the great talent that is now a part of the system any more than could the newspaper attract the talent it now possesses if the only reward was the dead level of mediocrity and the small emolu-

ment that it is possible for the Government to proffer. Editor Brisbane is represented to be one of the highest salaried men in the country today. If the Government ownership was extended to the daily newspapers, which it may be admitted carry on an interstate business, we wonder whether he would be satisfied with the salary that would go along with a Government job.

On the other hand, the proposal of the American Telephone & Telegraph Company to dispose of its holdings in the Western Union Telegraph Company; to refrain from any further acquisition of independent or competing exchanges and lines of communication; its voluntary extending of its long-distance facilities for connection with independent companies, receives a most favorable and enthusiastic reception from the public and press. The good will that is immediately inspired upon all sides, which has received particular emphasis upon the part of the President of the United States and the Attorney-General, emphasizes the greatness of mind and the bigness of spirit of the men who could suggest such an unexampled step. There has probably been no time in the history of the country when such exemplification of courage and farsightedness could have such a tonic effect. It will restore confidence in the entire business situation.

It is well known by those who are familiar with the situation that the exceptional ability of the officers of the American Telephone & Telegraph Company galvanized into life a telegraph service over which a few years ago there was considerable apprehension, if not despondency. In a remarkably short time there has been instituted great improvements in service; the co-ordinating of the two arms of the wire system has resulted in better facilities; a lowering of rates; we have the "night letter," the "day letter" and lower rates on deferred cablegrams; we have had established what is practically a telegraph station wherever a telephone has been installed, and in every direction improvement of conditions and increased efficiency of operation have been evident. It would indeed be unfortunate if the Government in its stern endeavor to interpret the Sherman Law in its relation to a combination obviously not in restraint of but for the betterment of trade shall dissolve or make ineffective this great work that has been so well established, and upon which so much of the commercial activity of the country depends.

THE ELECTRIC VEHICLE FOR CHRISTMAS DELIVERIES.

In many of our large cities, preceding the Christmas holidays, department stores and merchants in general devoted considerable space in their daily newspaper advertisements to announcements relative to their efficient delivery systems. In almost every instance delivery of all purchases made up until closing time on Christmas Eve were promised in time for presentation on Christmas morning. In large centers like New York and Chicago this entailed deliveries over many miles of territory.

It is a significant fact that most of the stores and express companies pledging themselves to this service employ the electric vehicle in some instances exclusively and in others in connection with gasoline trucks for long haulage. It is certainly gratifying, therefore, to see a public acknowledgment of the merits of electric delivery and in some cases to have the merchants make the unqualified statement that their delivery systems were efficient to the highest degree.

Department stores, express companies and others operating comprehensive delivery systems, covering large areas and entailing frequent stops, have long realized the superior merits of the electric vehicle. Especially during the congestion incident to the Christmas rush does the electric prove its worth, and if the weather is inclement, as is frequently true, the value of the motor-driven car is emphasized.

Those interested in the further increase in the use of electric vehicles for commercial service would do well to make capital of the sentiment created in favor of electrics during the rush season.

STREET LIGHTING ON DARK DAYS.

When contracts are made for street lighting it is customary to consider only the night hours. In the larger communities provision is usually made for lighting from dusk to dawn and in the smaller communities lighting may be carried out from dusk to midnight, or on only those nights when there is no moonlight. When lighting is arranged upon a moonlight schedule there should be some provision in the contract for operating lamps on those nights when the schedule indicates moonlight, but the weather is too cloudy to permit Luna's beams to reach the earth. Otherwise there will be too frequent occasions when the streets will be left in darkness.

Similar provisions should be made for lighting on very dark days during daylight hours, regardless of what form of night schedule is in effect. In some localities there may be no occasion for resorting to this expedient at any time during the year, but in other localities it is quite possible to have such an inky darkness from fog or clouds as to make it highly desirable to have artificial lighting. This is especially true in the larger cities. An instance of this occurred in Chicago on December 24. About 9 a. m. on that date the clouds gathered so thickly as to give the aspect of night and without any light from the street lamps the crossing of crowded thoroughfares became almost dangerous. Naturally the team traffic was much heavier than is ordinarily the case at night. Before noon of that day street lamps were switched on and kept on during the remainder of the day. This, of course, is an unusual occurrence, but it is always safe in drawing up contracts to provide for any contingencies that may arise.

METERS FOR TWO-RATE SYSTEMS.

In discussing the question raised by the Uniform Electric Rate Association in the issue of November 1, it was pointed out that differences in the use to which electrical energy was put justified differences in rates, providing these uses differed as to the time of day and the duration of the demand made upon the power station. It should be recognized that it is primarily these differences in load-factor and in the time of use rather than any inherent difference in the purpose of use which justifies the difference in rates. If metering arrangements could be so made as to take proper cognizance of these differences in time of use and in relation of total consumption to maximum demand, it would be unnecessary to classify customers according to the kind of service desired.

Recognition of this time element and its bearing upon the cost of electric service has led to the proposal of various metering devices which have been devised with the idea of covering this point. By means of clock work it is possible to register the consumption at different periods of the day upon different meter dials and then charge up at a different rate energy consumed during the peak period and during the off-peak period. While such an arrangement gives an admirable result, it is open to the objections of complication and consequent increased cost in metering and the necessity of periodic winding of the clock mechanism. The latter feature could be overcome by a system of electric winding, but this again introduces further complications. For the above reasons there has not been a very wide application of this type of meter.

The article published two weeks ago by Mr. H. H. Perry presented a method of recording energy consumption upon two different dials at different times without the use of clock mechanism. The criterion as to whether the consumption should be recorded upon the high-rate meter or the low-rate meter was the amount of current flowing in the lighting circuit or in one modification of the plan a differential resultant between the current used for lighting and for power purposes. Under this scheme the consumer pays at a high rate when his load is large regardless of all other conditions and at a low rate when his load is low, also regardless of the fact that this may be at the time of peak load upon the central station.

Such a scheme has indeed the merit of avoiding the clock mechanism, but this is about the full extent of its merit. It utterly fails to take into account the main reason for charging the customer at different rates at different times. It permits a low demand to be charged at a low rate during the peak hours and charges a high load at a high rate at off-peak hours when the aim should be to encourage the use of current. Its only justification is found in the probability that the individual customer will follow the average practice and use his maximum load during the peak hours. The system, however, does not encourage him to use this maximum load at other periods.

Considering the complications of this method of metering, it seems to have little advantage over the more customary and quite feasible one of segregating customers according to the kind of service and scheduling different rates for these different kinds, installing two or more meters where it is necessary to distinguish between energy used for lighting, for power and for other purposes.

A much better scheme for changing the registration from the low-rate dial to the high-rate dial and *vice versa* was proposed some time ago. This was to provide mechanism for the shifting which would be operated by a high-frequency alternating current sent out from the central station at a definite time. The peak period, during which the high rate is to be charged, is definitely fixed, and the high-frequency impulse sent over the mains at the beginning and end of this period. The period could be made different at different seasons of the year, if so desired. The superposition of such a high-frequency impulse, of low amplitude, upon the normal current flowing in the mains, would not affect lamps or motors, and only apparatus adjusted to respond to it would give any indication of its presence.

DIVERSITY-FACTOR.

The term "diversity-factor" appears to have been first used to designate the ratio of the sum of individual consumers' demands to the total demand upon the power house. In substance this is the definition adopted by the International Electrotechnical Commission and it is the one given in the Standardization Rules of the American Institute of Electrical Engineers. A different definition has more recently been suggested and has been adopted by the National Electric Light Association. The new definition makes the diversity-factor the reciprocal of the quantity indicated by the old definition, and the reason for making the change is that the proper fraction or percentage thus indicated will be more useful in simplifying computations and in presenting to the mind the main idea involved. This fraction is the quantity by which the sum of consumers' demands must be multiplied in order to give the necessary capacity of the supply machinery.

Our contemporary, *The Electrician,* of London, has raised the objection to the definition which gives a fractional numerical quantity for the diversity-factor that it does not inherently correspond to the idea represented by the word "diversity." That is to say, the smaller numercial quantity would represent a greater diversity. An analogy is suggested to the use of "efficiency" to represent the specific consumption of an incandescent lamp, a practice which we are only just beginning to outgrow.

The objection seems a valid one, and yet on the other hand it must be admitted that the fractional quantity is a very useful one in practice. If the fraction is not to be called diversity-factor we should find some other name for it, just as we have for the "efficiency" of the incandescent lamp. It should not be hard to find a suitable term. Perhaps "congruity-factor" would do; or perhaps "conformity-factor" would be better.

International Electrical Congress.

The International Electrical Congress is to be held at San Francisco, September 13 to 18, 1915, under the auspices of the American Institute of Electrical Engineers, by authority of the International Electrotechnical Commission, and during the Panama-Pacific International Exposition. Dr. C. P. Steinmetz has accepted the honorary presidency of the Congress. The deliberations of the Congress will be divided among twelve sections which will deal exclusively with electricity and electrical practice. There will probably be about 250 papers. The first membership invitations will be issued in February or March, 1914.

Attention is drawn to the distinction between this Electrical Congress and the International Engineering Congress which will be held at San Francisco during the week immediately following the electrical congress. The engineering congress is supported by the Societies of Civil, Mechanical and Marine Engineers and by the Institutes of Mining and Electrical Engineers, as well as by prominent Pacific Coast engineers who are actively engaged in organizing it. This Congress will deal with engineering in a general sense, electrical engineering subjects being limited to one of the eleven sections, which will include about twelve papers, treating more particularly applications of electricity in other engineering work.

The meeting of the International Electrotechnical Commission will be held during the week preceding the Electrical Congress.

Mid-Year Meeting and Dinner of the American Electric Railway Association.

The next mid-year meeting of the American Electric Railway Association will be held at the Engineering Society's building, New York City, January 29, 30 and 31, 1914.

The annual dinner will take place on the evening of Thursday, January 29, at the Waldorf-Astoria Hotel. Heretofore the annual dinner has been at the expense and through the courtesy of the American Electric Railway Manufacturers' Association. The executive committee of the American Association, however, at its meeting in Atlantic City, passed a resolution providing that instead of being a complimentary affair, the dinner should be one where each pay his own way. Under this arrangement any subscriber may invite as many guests as he may desire.

Southwestern Electrical Convention.

The 1914 convention of the Southwestern Electrical and Gas Association will be held at Galveston, Tex., on May 22, 23, 24 and 25.

Jovian Chapter, Electrical League of Cleveland, Holds Annual Meeting.

The Jovian Chapter of the Electrical League of Cleveland, held its annual meeting, smoker and election of officers at the Hollenden Hotel on the evening of December 18. J. Robert Crouse presided in the absence of Thomas Cagwin, who was obliged to be absent from the city. Mr. Crouse delivered an interesting address on co-operation and harmony as the two essential elements contributing to success and continued growth in the industry. T. S. Mook, the guest of the evening, described the plans of the city of Cleveland for a municipal Christmas festival. N. C. Cotabish spoke briefly on Jovianism, and the opportunities affiliation with the Order afforded for the personal efforts of the members of the Order in promoting better conditions. A vaudeville entertainment was given during the balloting for officers, the election resulting as follows:

President, George S. Milner; first vice-president, M. H. Moffett; second vice-president, F. M. Grant; third vice-president, J. T. Kermade; fourth vice-president, N. H. Boynton; secretary and treasurer, Robert G. Pate; trustees, Harry Swindell, A. E. Beling, H. B. Gay, M. E. Turner.

Jovian League of Chicago.

William J. Norton of Chicago spoke before the Jovian League of Chicago on December 22, discussing some phases of the new Illinois public-service commission law which becomes effective January 1, 1914. Mr. Norton spoke of the need of regulation and discussed the question of home rule versus state regulation. While certain features such as granting of franchises, use of streets, service, etc., logically come under city jurisdiction, regulation by state commission is more uniform, more efficient and more economical. The most important objection to local regulation, however, is that it is generally made a political issue, and as such is unjust to the public and to the companies.

Mike S. Hart presided at the meeting in the absence of Statesman Niesz.

Philadelphia Vehicle Section Organized.

The Philadelphia Section of the Electric Vehicle Association of America was inaugurated at a meeting held December 15, 1913. A constitution was adopted and the following officers elected: chairman, R. Louis Lloyd; vice-chairman, A. W. Young; secretary-treasurer, J. Crawford Bartlett; executive committee: W. H. Johnson, E. R. Whitney, Fred B. Neelly, James M. Skinner, Carroll A. Haines. Meetings will be held on the second Wednesday of each month.

Meeting of Brooklyn Section.

At an enthusiastic meeting of the Brooklyn Company Section of the National Electric Light Association, held on December 9, W. F. Wells, vice-president and general manager of the Edison Electric Illuminating Company of Brooklyn, announced that the directors of the company at their last meeting had voted to continue for the present year the policy of profit sharing which has been in force for three years. This involves the distribution among over 900 employees of approximately $60,000. Mr. Wells indicated that the profit sharing really meant an additional month's wages to the employees of the company.

It may be of interest in this connection to note that the profit sharing is given on a basis of years of service, the employee having been with the company two years receiving two per cent of his annual salary, and the employee five years or over, eight per cent, with varying percentages between. This year more than 400 employees will receive eight per cent upon their salaries.

Much of the employee's profit shares of previous years is invested in the Edison Investment Fund, conducted by the company without any administrative charges, and it has been paying employees six per cent compounded quarterly. This fund with the profit sharing of 1913 added, will exceed $300,000; the property of approximately 1,100 employees.

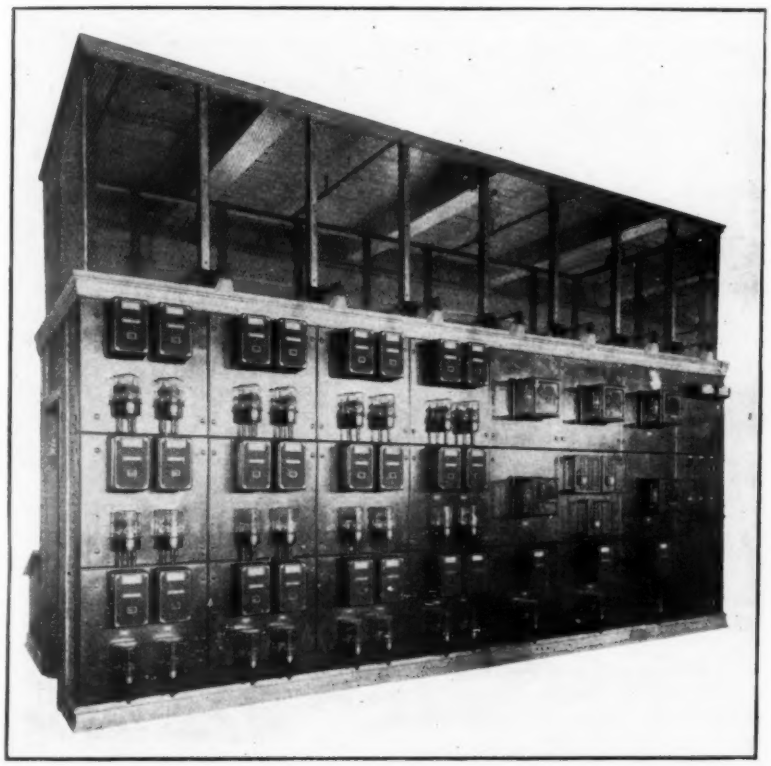
The program in addition to Mr. Wells' announcement, included the presentation and discussion of a paper entitled. "Handling the Customer's Account," and a talk by Andrew McLean, editor of the Brooklyn *Citizen*. Mr. McLean delivered a scholarly and eloquent address on "Relations Between Employee and Employer: Between Capital and Labor, From Historic, Economic and Social Viewpoints." His remarks delighted the 500 members of the Section present and he was given a rousing vote of thanks. Vaudeville supplied by home talent, and refreshments, followed.

Pittsburgh Section Dinner.

The monthly dinner of the Duquesne Light Company Section of the National Electric Light Association was held in Pittsburgh on December 18 in the Hotel Rittenhouse. About 300 were present and addresses were made by a number of the officers of the company. Those who spoke were President J. D. Callery, General Manager R. S. Orr, Contract Manager William A. Donkin, District Superintendent J. D. Patterson, William Keating, W. L. Oswald and Henry Harris. Mr. Callery in his address advocated the foundation of a relief fund for the benefit of the employees of the company. The suggestion was well received and a committee will be appointed to confer with President Callery on the subject.

Centralized Control System for the Panama Canal Locks.

The electrical specifications, design and manufacture of the Panama Canal centralized control system may properly be regarded as one of those undertakings which, from an engineering standpoint, not only arouses a lively interest but also presents an opportunity for much valuable instruction. The interest results mainly from the immensity of the Canal project itself, and the instruction from a consideration of the methods employed to insure the passage of even the largest ships afloat across the Isthmus with speed and safety. The complete operation of the Canal locks, terminals and auxiliary equipment utilizes electrical energy throughout, with the present exception of the Panama Railroad, the electrification of which is under contemplation.



Rear View of 2200-Volt Instrument and Control Board for Gatun Hydroelectric Station.

The specifications for the entire generating, lock-controlling and distribution system for operating the Panama Canal were prepared under the supervision of Edward Schildhauer, electrical and mechanical engineer of the Isthmian Canal Commission, assisted by a staff of able electrical engineers, including C. B. Larzelere and W. R. McCann, who were closely identified with the lock-control problems, and with the generation and distribution of power, respectively. These specifications exhibited great care and painstaking engineering. They contained every safeguard that expert engineers could suggest, were exact and explicit in regard to the results required, yet gave proper range in the details of the apparatus.

Generation and Distribution.

The power system for the operation of the locks, towing locomotives, lights for the locks and buildings, and motors not directly connected with the lock control, is composed of:

A 7,500-kilowatt, 2,200-volt hydroelectric power plant at the Gatun Dam.

A 4,500-kilowatt, 2,200-volt Curtis turbogenerator electric power plant at Miraflores for emergency, lately used to supply power for construction work.

A double 44,000-volt transmission line across the Isthmus, connecting Cristobal and Balboa with the two power plants.

Four 44,000/2,200-volt substations, stepping down at Cristobal and Balboa, and up or down at Gatun and Miraflores, depending on which of the two plants is supplying power.

Thirty-six 2,200/240-volt transmission stations for power, traction and light at Gatun, Pedro Miguel and Miraflores locks.

Three 2,200/220-110-volt transformer stations for the control boards at the locks.

Stations at Cristobal and Balboa for coal-handling plants, machine shops and dry docks.

The system of connection throughout employs a double-bus, double-switch scheme, with provision for disconnecting any oil switch for cleaning or repairs without interrupting the circuit. In the power house and the four 44,000/2,200-volt substations, the oil switches are solenoid-operated and are installed on concrete cells, above which are concrete fireproof compartments containing the two sets of buses. In the 36 transformer stations in the lock walls, the oil switches are hand-operated. All 2,200-volt oil switches have disconnecting switches, so arranged that live parts are completely covered.

For the hand-operated switches, a pipe framework supports vertical metal guides which carry the oil-switch operating mechanism and slate base forming a section of the switchboard panel. On the guides a lever and toggle mechanism is mounted, by which the oil switch and slate base may be raised and lowered. Above the oil switch and mounted on the pipe framework a stationary cast-iron base carries the disconnecting-switch studs and insulators. The high-tension leads run to the tops of the disconnecting-switch studs, and the bottom of each stud is equipped with contact fingers. On the top of each oil-switch stud is mounted a contact blade. When the oil switch is raised, these blades engage the contacts on the bottom of the disconnecting-switch studs, which thus in the closed position form extensions of the oil-switch studs. The disconnecting-switch contacts are surrounded by insulating shields which prevent accidental contact. When the oil switch is lowered, it is completely isolated from the circuit. When the oil switch is raised, it always goes to a fixed height where it is latched. An interlock prevents the oil switch from being raised or lowered unless its contacts are open, precluding the circuit being closed or opened by the disconnecting switch. In some instances another interlock makes two single-throw switches a double-throw switch and prevents both switches being closed at the same time.

For solenoid-operated switches, the same form of disconnecting switch is used; but the solenoid is stationary and the connecting mechanism to the oil switch has a vertical slotted link which allows the oil switch to be raised and lowered without being disconnected from the solenoid mechanism. A mechanical interlock prevents the raising or lowering of an oil switch while in the closed position.

The instrument and control board for the Gatun generating station is of natural black slate, as are all the switchboards

for the power system. It is totally inclosed by means of grille work with doors at each end. The switchboards for the transmission-line substations are of the vertical type, with control apparatus and mimic connections symmetrically arranged on the middle section of the panels. The rear of the board is inclosed by means of grille work with doors at each end.

Power Supply and Control Panels for Lock-Machinery Motors.

Current for the lock machinery and towing locomotives is transformed from the 2,200-volt system in the immediate vicinity where it is used. There are a total of 36 transformer stations, for all locks, each containing duplicate 200-kilowatt, three-phase 2,200/240-volt transformers for power and one single-phase 25-kilowatt, 2,200/220-110-volt transformer for lighting. The stations, normally fed from the 2,200-volt buses in the 44,000/2,200-volt substations, can also be operated from the power plants; the stations at Gatun locks from the Gatun hydroelectric station; and the stations at Miraflores and Pedro Miguel from the Miraflores emergency steam plant.

To give an idea of the number and sizes of motors to be controlled in operating the lock machinery, the table below is interesting.

There are many motors not included, as, for instance, those for the spillway gates, for the hand rails on the mitering gates and for the sump pumps. The spillway gates are remote-controlled from a special control board, and the control of the hand-rail motors is given in connection with the discussion of mitering gates.

The motors are started and controlled by contactor panels located near them, the contactors of which handle the main motor currents. These contactors are controlled from the central control house. The smaller motors, including those for cylindrical valves, auxiliary culvert valves and miter forcing, are started by being thrown directly on the line. Two double-pole contactors are used, one for forward and one for reverse. In the case of larger motors for miter-gate moving, rising-stem valves and guard valves, a starting point with resistance in two legs of the three-phase circuit is provided.

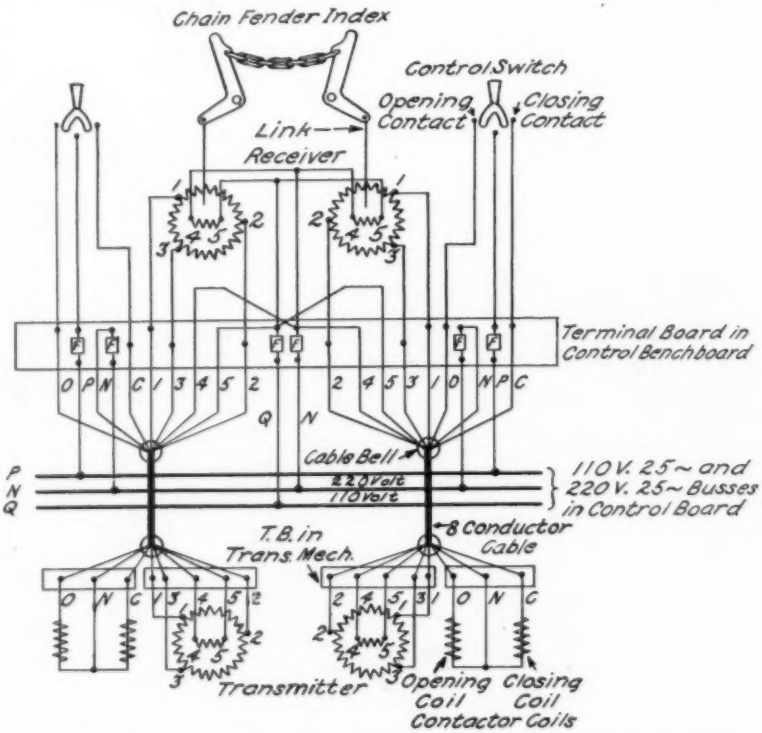
In all cases the contactors are operated from the control boards—to be described later—by three wires, one for forward, one for reverse and a common return. In the case of panels having a starting point, the period during which the motor remains on the resistance is automatically controlled by a dashpot, so that the starting operation at the control house is the same, simply energizing a forward or reverse wire as the case may be. The control connections are arranged in such manner that each individual machine may be controlled locally. This arrangement provides for emergency operation should the control circuits from the central control house be out of order.

Location and Operation of Lock Machinery.

From an operating standpoint the machinery was placed below the coping of the lock walls, thus affording a clear space for maneuvering ships and protecting the apparatus from the weather without erecting numerous houses.

The mitering gates consist of two massive leaves pivoted on the lock walls which operate independently of each other. A pair of gates is located where each change of level occurs and divides the locks into 1,000-foot chambers. In addition to these gates, at lake and ocean ends are duplicate pairs of gates used as guard gates. To handle the vessels of various sizes with the minimum use of water, mitering gates of the same description as those above are installed, dividing 1,000-foot locks into two compartments. These gates are termed intermediate mitering gates. When the mitering gates are closed they are what might be termed clamped in this position by a device called a miter-forcing machine.

On the top of all mitering gates a foot walk with hand rails is provided. When the gates are opened and in the recesses provided for them in the lock walls, these hand rails would interfere with the passing of the towing locomotives, except in the case of the lower guard gates. The hand rails are therefore made to be raised and lowered. This is done by a motor under the foot walk, controlled from the lock wall. Near the approach to each foot walk a controller is located in the lock wall flush with the surface, this controller being operated by a foot push. If the gates are closed and the hand rails are down, and it is desired to cross on the gates, the foot push is pressed and the hand rails are raised by their motors. This is true not only of the hand rails on the nearer gate leaf, but of the hand rails on the farther leaf as well. After passing across, one can, if one desires, press the foot push on the other side and both hand rails will be lowered. Or, if one leaves the hand rails up and the gates are opened by the operator in the control house, they will be automatically lowered so as to be out of the way when the gate is in the



Control Switches and Synchronous Position Indicator for Chain Fender Index.

Machines and Operation—	Number of motors to each machine	Horse-power	Number of Motors—Gatun	Pedro Miguel	Miraflores	Total	Total Horse-power
Miter gate, moving, each leaf	1	25	40	24	28	92	2,300
Miter gate, miter forcing	1	7	20	12	14	46	322
Fender chain, main pump	1	70	16	16	16	48	3,360
Fender chain, operating valve	1	0.5	16	16	16	48	24
Rising-stem gate valve	1	40	56	24	36	116	4,640
Cylindrical valve	1	7	60	20	40	120	840
Guard valve	1	25	6	6	6	18	450
Auxiliary culvert valve	1	4	4	4	4	12	84
Totals			218	122	160	500	12,020

recess. When the gates are again closed, the hand rails will automatically rise again if the foot controller has been operated in the meantime. The hand rails cannot be raised when the gates are opened, and no harm results if the foot switch is operated while the gates are in the closed position.

The chain fenders are stretched across the canal in front of all mitering gates which can be exposed to the upper lock level and also in front of the guard gates at the lower end. These chains are maintained in a taut position when the gates behind are closed, and are lowered when the gates are opened for the passage of a ship. The chains are raised and lowered by a method similar to that followed in hydraulic elevators, with the additional feature that if a ship approaches the gates at a dangerous speed and rams into the chain, the chain is paid out in such a way as to gradually stop the ship before it reaches the gates. Lowering the chain for the passage of a vessel and raising it again after the vessel has passed is accomplished by two motors; one driving the main pump supplying water under pressure, and the other operating a valve which controls the direction of movement of the chain. These two operations are combined in one, each motor being stopped automatically by a limit switch when the motor has performed its function.

The filling and emptying of the locks is accomplished by three culverts, one in the middle wall and one in each side wall, the flow of water being controlled by rising-stem valves. They are located in the culverts at points opposite each end of each lock so that the culvert can be shut off at any desired point for filling a lock with water from above, or upstream, or for emptying it by allowing it to flow out and down to the next lock. Lateral culverts conduct the water from the main culverts, under the lock chambers, and up through openings in the lock floors.

The rising-stem valves are installed in pairs, and each pair is in duplicate; also each culvert is divided into two parallel halves at these valves by a vertical wall. This arrangement reduces the size of each valve and makes it more easily operated, each valve being 8 by 18 feet. One pair of duplicates is left open as a guard, or reverse pair; the other pair is used for operating, so that in case of an obstruction in the culvert or accident to the machinery, the duplicate pair can be used.

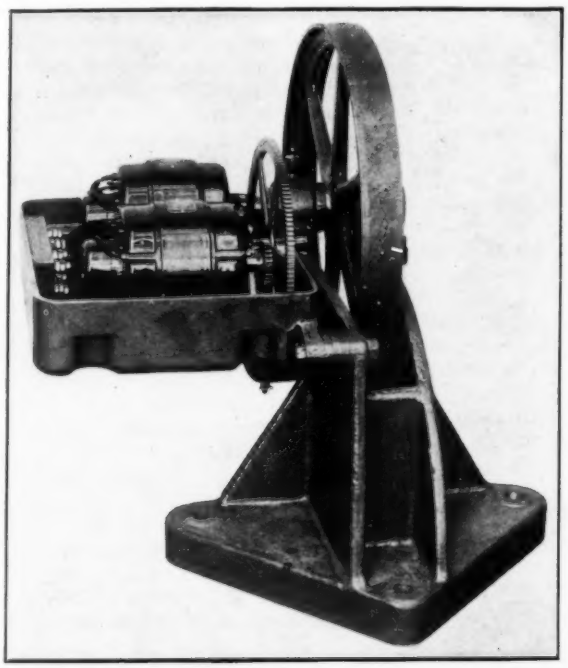
At the upper ends of the culverts at the side walls, the duplication is accomplished by three valves in parallel, called the guard valves. They perform service exactly similar to the rising-stem valves, except that three valves in parallel in this case must conform to the same laws as the two in parallel in the other case.

The culvert in the middle wall must serve the locks on both sides, and to control this feature cylindrical valves are placed in the lateral culverts that branch out on each side. There are ten of these on each side of the culvert at each lock.

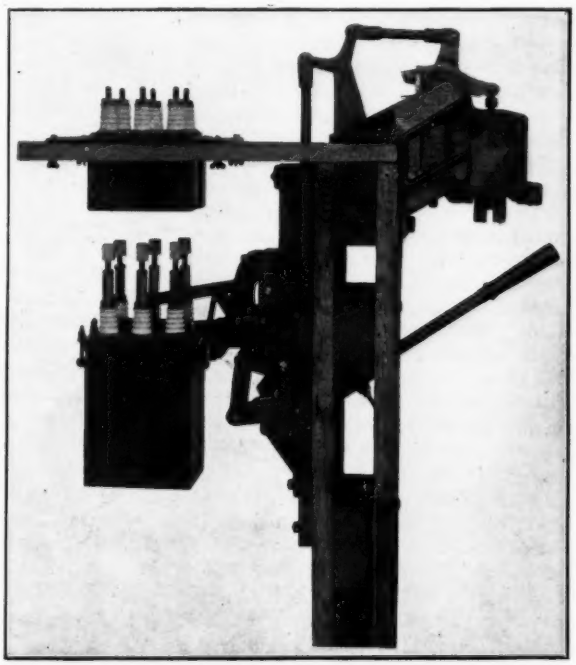
At the upper end of each set of locks, there are two valves in the side wall for regulating the height of water between the upper gate and upper guard gate, as it is desired to maintain the level of the water between these gates at an elevation intermediate between that of the lake above and that of the upper lock when the upper lock is not at the same level as the lake. These valves are called the auxiliary culvert valves.

Reasons for Using the Control System Adopted.

As the flight of locks at Gatun, for instance, extends over approximately 6,200 feet, and the principal operating machines are distributed over a distance of about 4,000 feet, it can be readily seen that central mechanical transmission of control of machines would be almost impossible; and to control the machines locally would mean a large operating force distributed practically along the full length of the locks, which has invariably been the practice heretofore. Such a force would be difficult to co-ordinate into an efficient operating system. The situation therefore resolved itself into centralized electrical control, which reduces the number of operators, operating expense, and liability to accident. To accomplish this system of control, a control board for each lock was constructed which permitted having all control switches located thereon mechanically interlocked so as to minimize, if not entirely prevent, the errors of human manipulations.



Floatwell Transmitter Machine.



Solenoid-Operated, 2500-Volt, 300-Ampere, Triple-Pole Switch.

Centralized Control and Indicating System.

The control boards are installed in control houses located on the middle walls at points which afford the best view of the locks, although this view is not depended on to know the position of the gates or other apparatus, as all are provided with indicators on the control board. The control boards are made approximately operating miniatures of

the locks themselves, and are arranged with indicating devices which will always show the position of valves, lock gates, chains and water levels in the various lock chambers; and with the exception of such machinery as needs only an "open" or "closed" indication, the indications will be synchronous with the movement of the lock machinery.

For such indication, appliances with commutators, multiple contacts or ratchet mechanism would not be suitable because of the many contacts and small pieces in their construction; and particularly because devices of this character move step by step and would not indicate all points in the movement of the main machinery, such indications being more or less approximate according to the number of steps in the indicating devices. The indicators on the Panama control boards were developed especially for this undertaking, and show accurately and synchronously every movement of the machinery to which they are connected, whether in the extremes of travel or at any intermediate point.

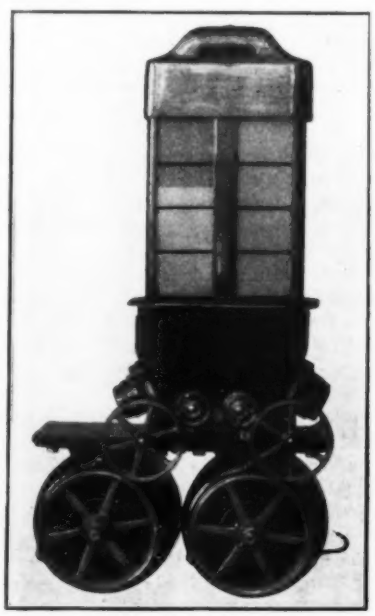
A complete synchronous indicator consists of a transmitter located at and operated by the machine in the lock wall, and a receiver operating an indicator at the switchboard in the control house. Both transmitter and receiver have a stationary and a rotating part. The stators have three-phase windings with leads from three corresponding equidistant points brought out and connected together, but not connected to a source of power, the stator coils being energized by induction from the rotors. The rotors are bipolar and are connected in multiple and energized from a 110-volt, 25-cycle single-phase source.

The movement of the lock machinery and with it the connected transmitter rotor produces a field in the transmitter stator polarized in the direction of the rotor axis, which induces voltage in the stator coils. This voltage is transmitted by the three-phase connection above mentioned to the receiver stator coils and duplicated in them, but in the reverse direction, the same conditions of polarity and voltage as present in the transmitter. The rotor of the receiver being energized by the external source in the same direction as that of the transmitter, is reacted upon by the polarized receiver stator until the magnetic axes coincide and the rotors of both transmitter and receiver are in the same relative position. Any difference in the position of the transmitter and receiver rotors causes a difference of potential between the stator windings with a consequent flow of current and resultant torque, which again moves the receiver rotor ,to the same relative position as that of the transmitter rotor. The receiver rotor follows closely and smoothly the movement of the tansmitter rotor, and consequently imparts to the position indicator a movement identical with the movement of the lock machine, although on a scale reduced to the requirements

Edward Schildhauer.

of the control board A brief description of the individual synchronous indicators follows:

In the case of the mitering gates, the vertical operating shaft is connected to a shaft which operates the transmitter machine. The latter shaft is threaded and carries a nut on which is mounted a rack. The rack engages a gear on the rotor shaft, and this turns the rotor as the gates operate. The mitering gate indicator comprises a pair of aluminum leaves, shaped to correspond to the plan view of the top of the gate, which travel horizontally just above the top of the board, the hinge ends being connected to shafts extending down through the surface of the board where they are geared to the receivers by means of bevel



Stoney Gate Valve Index for Lock Control Board.

gears. When the miniature gates are completely opened they are covered by shields to give the effect of the gates folding back into recesses in the lock walls.

For the chain fender, the position-indicator transmitter is driven by the shaft which operates the limit switch that controls the stroke of the piston. The indication on the board is given by a small aluminum chain, which, like the large chain, is raised and lowered, each end operating independently, the large chain being lowered to the bottom of the lock and the small chain into a slot on the control board. The ends of the miniature chain are fastened to semaphore arms which are connected to segmental gears meshing with the driving gears on the receiver machines. As the receiver rotors turn, the chain is either lifted or lowered, the position of the large chain from the bottom of the lock being indicated by the angle of the semaphore arms.

As the rising-stem valves occur in pairs, their position-indicator machines occur in pairs also. The transmitter rotor is diven by a shaft and gearing similar to that described for the mitering gates. Each indicator is similar to a small elevator, a car being used to indicate the position of the valve gate. Both front and back of the shaft is fitted with opal glass marked with black lines for the ¼, ½ and ¾ positions. A small aluminum cage moves up and down in each compartment. A drum for operating the cord which raises and lowers the cage is located underneath the control board and is operated by the receiver through a suitable train of gears. To make the indications visible from points up and down the control board, the elevator shaft under each car is always illuminated and the portion above is dark.

Water-Level Indicators.

The specifications covering the water-level indication required an accuracy of 0.05 foot or 0.1 per cent in actual water level. In the transmitters and receivers for the machines described previously the rotors turn less than 180 degrees with an inherent lag of 1.5 per cent between transmitter and receiver rotors in this distance, which obviously prevents this arrangement from being employed to give the water-level indication.

It was found that if the rotors were revolved ten complete revolutions, the required accuracy could be obtained; but since this arrangement makes it possible for the rotors to be in synchronism every 180 degrees, or in twenty different positions for the entire travel, the indicators would not indicate correctly if for some reason the transmitter rotors were turned more than a half revolution with the power off. Therefore, the required accuracy was obtained by two sets of

transmitters and receivers, one set connected to a fine index in which the rotors make ten complete revolutions and the other set connected to a coarse index operating less than 180 degrees.

The fine index is a hollow cylinder carrying a pointer, the length of the cylinder being such that when an aluminum ball representing the coarse index, which can be depended upon for coarse indication, is within the limits of the cylinder, the reading of the fine index is correct within the limits specified. The scales are illuminated by lamps in both base and top caps of the indicator.

For water-level indication, walls 36 inches square in the lock walls with communication to the lock by a small opening at the bottom of the well to dampen surges, contain a welded-steel box float, 30 inches square by 9 inches deep. A non-slipping phosphor-bronze belt transmits the movement of the float to a sheave fitted with pins on the transmitter mechanism, the pins registering with holes punched in the belt. The sheave shaft is carried in ball bearings with oil cups for lubrication and drainage cocks at the bottom of the bearings.

The position of the miter forcing machine is not indicated by synchronous indicators, but its open and closed positions are shown by red and green lights and a mechanical indicator on the control board representing the machine.

Control Boards Represent Locks In Miniature.

The control boards are of the flat-top benchboard type, 3 inches high by 54 inches wide, built in sections, with total lengths as follows:

Gatun	64 feet
Pedro Miguel	36 feet
Miraflores	52 feet

The side and center walls of the locks are represented by cast-iron plates and the water in the locks by blue Vermont marble slabs. The outer edge of the board is surrounded by a brass trim rail,

50-Foot Floatwell Index.

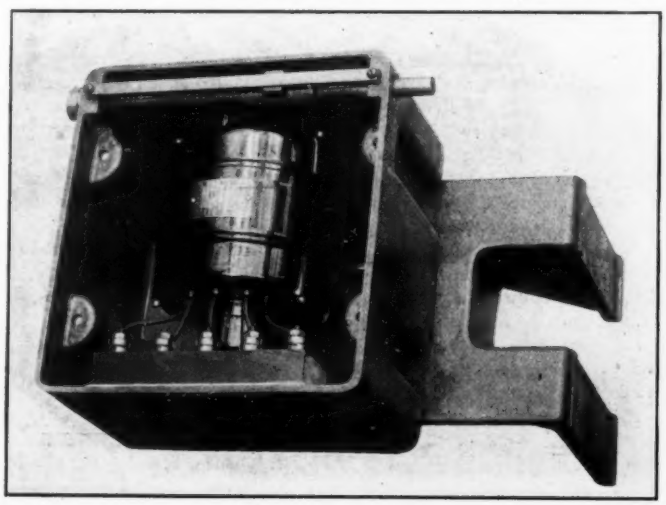
and the sides are inclosed with steel plates which can be readily removed for inspection of the board. The control board is supported by a wrought-iron framework resting on base castings, which are in turn supported on the operating floor of the control house.

The control-switch handles are mounted above the surface of the board and operate through an angle of 90 degrees. They are provided with name plates for the "open," "closed" and "off" positions. The space immediately below the flat top of the control board is occupied by the contact fingers of the control switches, mounted on the operating shaft, synchronous receivers and their cable connections. Connection boards are provided for the cables, which are led up from each side, as are buses for supplying current to the control switches, receivers and the lamps that illuminate the scales of indicators. The receivers, transmitters and lamps are operated at 110 volts, while the control circuits use 220 volts, both using 25-cycle alternating current.

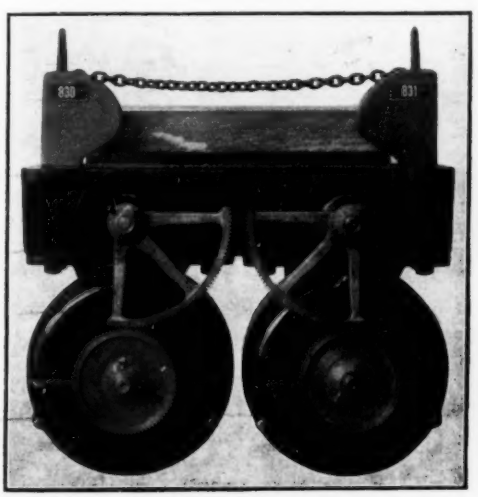
Mechanical Interlocking System.

In order to make it necessary for the operator to maneuver the control-switch handles always in a certain order, corresponding to a predetermined sequence of operation of the lock machinery, and to prevent the operator in control of one channel from interfering with the machinery under the jurisdiction of the operator controlling the other channel, these control switches are provided with interlocks. The interlocks are in two vertical racks under each edge of the board and some distance below, so that they may be inspected and oiled from a floor which is about seven feet below the floor on which the switchboard operator stands. The latter floor does not extend across under the board, this space being open so that all parts on the underside of the board are accessible from the floor below.

Vertical shafts operated by connecting rods from the control switch shafts extend downward past the electrical parts for the operation of the interlocks. The interlock system is essentially a bell-crank mechanism, connecting the shaft of the control switch through a movable horizontal bar to a vertical operating shaft which can or can not move according to the relative positions of the interlocking bars and dogs. The interlocking rack is a steel frame carrying five horizontal members. Upon these and tying them together are vertical steel straps which carry brass runway posts for the vertical and horizontal interlock bars. These



Chain-Fender Transmitter.



Chain-Fender Indicator.

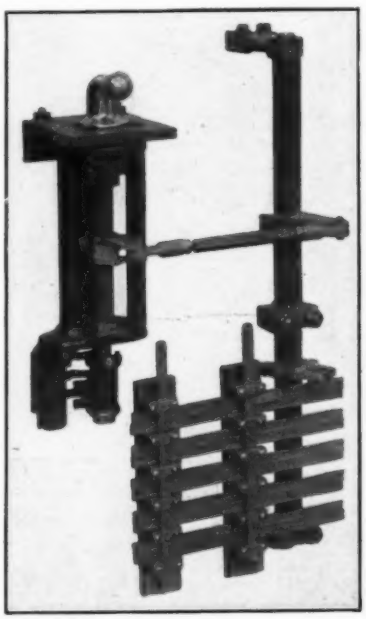
posts are riveted to the vertical steel straps, a thin brass plate between posts and straps making the runways non-corrosive. The vertical operating shafts are of square steel turned on the ends and work in brass bearings near the top and bottom of the interlocking rack. Forked cranks mounted on the vertical operating shafts move the horizontal interlock bars by means of pivot blocks set over pin blocks riveted to the horizontal bar. The interlock bars and dogs are of special shape hard extruded brass, which section keeps the dogs in line with the axis of the bars when under pressure by being engaged with another dog on a vertical bar. Every control switch uses a horizontal bar from 3 to 50 feet long.

The interlock system depends mainly on the action of engaging bevel dogs located on horizontal and vertical bars, the movement of a horizontal bar tending to lift a vertical bar by bevels on the dogs. A horizontal bar can not be moved without raising a vertical bar. Thus, if at any time a dog on a horizontal bar rests against the upper end of a dog on a vertical bar, no movement of the horizontal bar where the dog engages with the vertical bar can take place, and the control handle connected to that particular horizontal bar is locked.

Interlocks prevent the chain fender from being lowered until adjacent mitering gates have been opened, and also prevent the gates being opened until the chain is in the raised position. In this way it is assured that the chain fender will always be in the up position to protect the gate when the gate is closed. To avoid unnecessary complication, each end of the chain is interlocked with the leaf on its side of the lock only, because as a rule both leaves of a gate, as well as both ends of a fender chain, will be opened simultaneously, and further interlocking is unnecessary. After the mitering gates are closed, a miter forcing machine is operated by a control handle and locks the ends of the gates closed. This machine cannot be operated until the gates are closed.

Also the rising-stem valves of the side wall, next above or below a miter gate, must be closed while the miter forcing machine is open. As the miter forcing machine cannot be closed until the gates are closed, this means that the valves either above or below the gate must remain closed until the gate itself is closed, thus preventing the operator from creating a current of water around the gates while they are open, or being moved in opening or closing. This interlock is not included on the middle wall valves for the reason that they will be used with the locks on either side and must be free for that purpose.

Either pair of rising-stem valves may be opened first, at the choice of the operator, an interlock becoming effective when the first valve of the second pair of duplicates is opened. This is done by a novel arrangement of equalizing levers acting against the ends of the interlock bars, with certain definite amount of lost motion which is taken up on opening the first pair of valves, thus putting the interlocks in operation on the next pair. To illustrate this operation, consider, for example, a side-wall culvert at Gatun with its principal rising-stem valves at each change of level from one lock to the next. The control of these valves is interlocked so that if the valves are opened at one particular point, the valves a lock length upstream or downstream cannot be opened. Thus the operator is limited to equalizing the water between locks and cannot allow water to flow from the upper lock past the middle



Control Switch and Interlock Mechanisms.

lock into the lower lock, which operation, if permitted, might flood the lower lock walls and the machinery chambers in them. The cylindrical valves are interlocked so that if those on one side are opened the ones on the other side are locked closed, and the opening of one switch on a side will lock the opposite ten. This prevents careless cross filling between locks, which operation might be combined with the regular method and produce flooding. However, there may be times when it is desirable to employ cross filling to economize in the use of water from Lake Gatun in the dry season. For this reason this interlock is made removable by the use of a Yale lock and key. The key will be placed in the hands of the chief operator.

In the use of the middle-wall culvert, the cylindrical valves on one side or the other must be opened before the rising-stem valves can be opened, and the rising-stem valves must be closed first. This interlock is applied in order to require the operator to control the flow of water by means of the rising-stem valves rather than by the cylindrical valves.

In most cases the locks are divided into two unequal parts by the intermediate mitering gates. This arrangement makes it necessary to divide the ten cylindrical valves into two groups of seven and three, respectively, for the long and short lengths. A selecting lever is provided for these interlocks and may be set as indicated by a nameplate on the lever to "three," "seven" or "ten," respectively; whereupon the corresponding valves are subject to that interlock, and the others of the group of ten are locked closed if three or seven only are to be used. The failure of the operator to make his selection properly in advance will simply cause him the trouble of going back and doing so, as the remaining valves are locked closed. This arrangement permits handling small vessels without causing waste of water due to operating such vessels in the large chambers. If a short vessel were being passed downstream, it would first pass into the chamber having three cylindrical valves. The group selective lever would then be placed on the "three" position, which would permit the opening of three valves above the intermediate gate, but would lock closed the other seven valves above it. After the vessel has been passed below the gate the handle may be reversed, releasing the lever and locking three switches.

There are intermediate rising-stem valves in the side walls at each intermediate gate, but no interlocks are applied to these for the reason that they will be used in a more or less irregular manner, and no fixed laws for their operation can be made in advance. Moreover, they control the water only between different sections of the same lock, and there is not the danger from mistakes in operation which exists in the case of the other valves which control water between lock levels. The same is true of the small auxiliary culvert valves, by means of which the space between the upper guard gate and upper main gate is filled and emptied.

In case a large vessel is to be locked through, the interlocks on the intermediate gates can be made ineffective by the operation of a Yale lock which uncouples a clutch and disconnects the central switch from the operating mechanism. Turning the key removes the interlock and permits the intermediate gates to be thrown open to obtain a 1,000-foot level and the valves operated independently of these gates.

To obviate the possibility of flooding the locks when valves are in a certain position, diagonal interlocking is introduced between the rising-stem valves of

the side wall and those of the middle wall a lock length away. This interlocking between valves diagonally across a lock when the cylindrical valves are open is needed to prevent the flow of water from, say, the upper lock by way of a side-wall culvert to the middle lock, thence by way of the middle-wall culvert to the lower lock, thus allowing an operator through carelessness to flood the lower-lock walls. If the cylindrical valves of a certain lock are closed, the interlock is not needed on the rising-stem valves of that lock; and since such interlock would interfere with the proper use of the valves of its twin lock on the other side of the middle wall, this interlock is automatically removed when all ten cylindrical valves are closed on the particular lock in question, and is automatically applied again if one or more of the ten cylindrical valves are opened. Furthermore, the valves of the side wall immediately at the gate which is being moved will be open to equalize water level, and diagonal interlocking will prevent the opening of the middle-wall valves a lock length above or below the gate being moved. Each of the four valves of such a group has independent control, their control switches being so interlocked that either pair may be opened and left open as guard valves, the interlocks becoming effective when the operator tries to open the first valve of the second pair. In addition to those pairs of valves in parallel, each pair is duplicated at each change of level from one lock to the next.

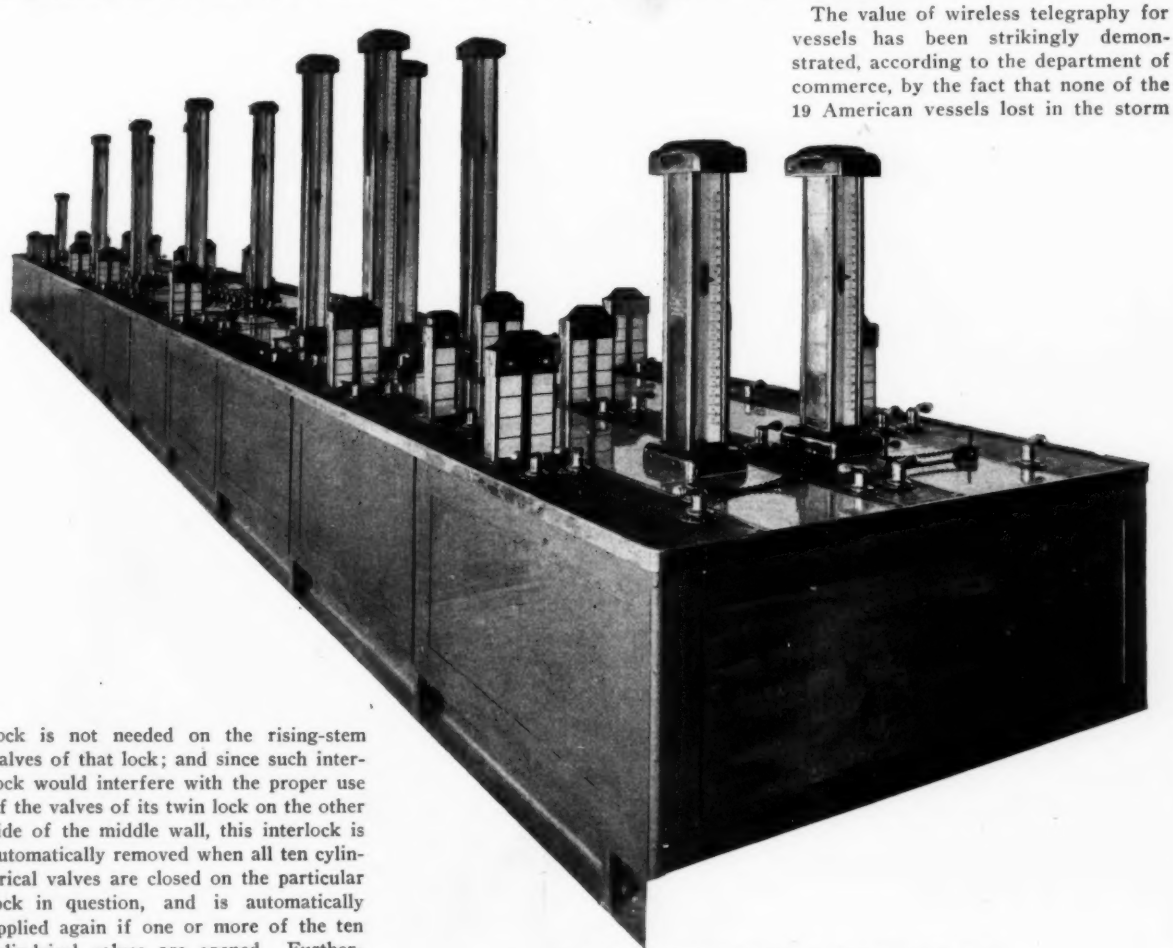
To withstand the humid atmosphere of the Isthmus, every insulated part, such as solenoid, relay, circuit-breaker and other coils, was impregnated with non-hygroscopic compounds. All small parts were made either of brass, copper, Monel metal, bronze, or of sherardized iron or steel. Mica and treated asbestos lumber were used largely in place of fiber or wood.

All the lock-machinery motors, control panels, centralized control boards, power station generating apparatus, switchboards, transmission-line substation equipments, coaling stations, and practically the entire electrical equipment for the wharf terminal cranes and for the extensive permanent repair machine shops were manufactured by the General Electric Company.

Nearly 2,000 special drawings were required in the fabrication, and there were also involved the following unusual quantities of materials:

Special slate bases	1,300
Small castings	160,000
Screw machine parts	1,200,000
Copper rod and bar, feet	58,000
Asbestos lumber, square feet	9,000
New patterns	650
New jigs, templates, tools, etc.	625
Porcelain parts	18,000
Special bus supports	6,800
Galvanized pipe (framework), feet.	21,000
Special gears	2,300
Special instruments	640
Miscellaneous sherardized pieces	300,000
Cases for boxing	4,150

The combined weight of the centralized control boards for Gatun, Pedro Miguel and Miraflores is about 39 tons. In their construction there is employed more than 2.25 miles of interlocking rod; about 6,000,000 feet of control leads—made up in 5 and 8-conductor cables; 732 indicator motors; 464 control switches.



Centralized Control Board for Miraflores Locks.

Value of Wireless Equipment for Vessels Strikingly Demonstrated.

The value of wireless telegraphy for vessels has been strikingly demonstrated, according to the department of commerce, by the fact that none of the 19 American vessels lost in the storm which swept the Great Lakes last month, was equipped with wireless apparatus, whereas the vessels which had wireless equipment received warnings of the coming storm and sought safety. This information has come to the department from its radio inspectors at Chicago and Cleveland.

About 50 vessels are preparing to install wireless equipment, the inspectors report, as a result of the lesson. The Cleveland inspector says that just before the storm three vessels cleared from Detroit, one with wireless, two without. The former, after attempting to warn the other two, returned to port and was saved, while those without wireless were lost.

Commercial Practice
Management, Rates, New Business

Central-Station Power for Large Chair Factory.

The Milne Chair Company, of Chattanooga, Tenn., represents the latest development in chair factory work in the South and marks an advancement in woodworking plants in Chattanooga. It is so located that it has two railroad connections, facilitating shipments, and has three spur tracks built into the warehouse and kilns.

This factory also represents the most efficient method of drive for woodworking plants. After investigating a number of factories in the North and East, it was decided to equip each and every machine with a separate motor, which eliminates any power losses due to belting, etc., and also maintains a constant speed on each machine so that the output is uniform throughout. This will likewise make an enormous saving in power consumption.

There is a very complete blower system installed for handling shavings, all shavings being handled directly from every machine to the cyclone above the boiler house. There are installed two boilers of sufficient capacity to take care of all kilns and all the heating.

The factory is purchasing power from a local power company, which ran its 6,600-volt line to the plant, stepping voltage down to 220 volts. The power company's line was built in ample time to install saws and elevators for building purposes, and this alone is an asset in building, obtaining cheap and reliable power for building operations. Even though this is a woodworking plant, it has been decided that it will be practical to use only shavings under the boilers and dispose of all blocks and small lumber as kindling and fire wood which will be much cheaper than burning same. It is expected that revenue from sale of this wood will practically pay for the power purchased from the water power company.

The power company's lines run directly to a five-section 220-volt, three-phase, 60-cycle switchboard equipped to take care of 660 horsepower total capacity. From this board power is distributed through three main circuits to three different sections of the plant, and also from this board the voltage is stepped down to 110 volts and the lighting circuits are taken care of from this central point. There is approximatedly 660 horsepower in induction motors installed, all being constant speed, three-phase, 60-cycle, 220-volt machines, with the exception of one multispeed motor on a special lathe. Total number of motors is about 110; averaging about 6 horsepower per motor.

Demonstration Board Loaned to Civil Service Commission.

Some little time ago the Civil Service Commission made application to The New York Edison Company for the loan of an apparatus to be used in conducting examinations for the position of superintendents of public school buildings. The Company agreed to construct and loan such an apparatus, and the matter was turned over to P. D. Rapelje, who designed a board containing a meter, switches, fuses, etc.—the idea being to group together such pieces of electrical equipment as were apt to be found in the public school buildings.

The following apparatus is mounted on the board: a three-wire and a two-wire meter with testing devices; a loop switch with fuses; various types of sealable cutouts; small knife switches with open and inclosed fuses; and at top three large wooden meter dials with hands capable of being moved so as to arrange different reading combinations.

Mr. Rapelje has also prepared a list of questions, which have a direct bearing on the apparatus and which, if satisfactorily answered, would indicate a candidate's familiarity with such electrical devices as he would be required to handle.

Special Sign Rate.

The New Bedford Gas and Edison Light Company, of New Bedford, Mass., has put into effect a rate of 5 cents per kilowatt-hour for energy supplied to electric signs. The company is inserting an advertisement in the local newspapers, calling attention to the advantages of tastefully trimmed store windows illuminated with attractive electric signs. "More light means more business," says the Company, and all the merchants of the city are called upon to "Get together for a brighter, bigger, busier new Bedford."

Slogan Sign at Toledo.

Toledo, O., has entered the ranks of the long list of progressive cities having slogan signs with what is considered one of the largest signs of its kind ever erected. On Wednesday, December 17, the sign was officially turned over to the city by officials of the Toledo Railways & Light Company, in the presence of the mayor and officers and members of the Chamber of Commerce.

The sign reading, "You Will Do Better in Toledo," is 78 feet long, 68 feet high and weighs 25 tons. It is lighted by 7,000 10-watt Mazda lamps. The flashes repeat every 30 seconds. The sign cost $12,000 and will be operated every night from dusk until midnight at an approximate cost of $42. It has been in the course of construction for two months. The expense of procuring and operating this sign is being stood exclusively by the Toledo Railways & Light Company which is one of the properties of H. L. Doherty & Company of New York.

New Office Building in Lexington, Ky.

A feature of the new building of the Kentucky Traction & Terminal Company, of Lexington, Ky., which operates the Lexington Utilities Company, is a display of current consuming devices, which is in charge of Eugene Creed, who has the title of new-business manager. The display is called "The Electrical Shop." All kinds of novelties of an electrical nature are carried, in addition to the usual line of devices. The new building contains a recreation room for trainmen employed by the traction company.

Electrics for Christmas Delivery.

One of the greatest tributes paid to the electric vehicle is the announcements of merchants of Chicago in the daily newspapers that all purchases made until closing time on Christmas Eve will be delivered in sufficient time for presentation on Christmas morning. It is a significant fact that these announcements are made by the large department stores using electric vehicles and the advertisements set forth the fact that the substitution of electrics for horse-drawn vehicles makes their delivery systems efficient to the highest degree.

Spectacular Sign of Commonwealth Edison Company.

The accompanying illustration shows an electric sign recently erected in Chicago which is one of the most effective central-station displays ever attempted.

"The Increase in the Amount of Electric Light $1 Will Now Purchase as Compared With 1896 and Intervening Years Is Shown By the Height of These Lamp Outlines. Phone Randolph 1280."

This is the message in running electric letters erected on the rear of the Commonwealth Edison Company's building at 28 North Market Street. The motograph is the name of the device by which this

Motograph Sign Erected for the Commonwealth Edison Company.

living electric message is run across the top of this sign like some gigantic stock ticker in letters six feet high.

In the meantime, the sign demonstrates the growth of the company's electric service, starting with the small lamp, which is still visible in the large photograph, entirely included in the base of the larger lamp and changing step by step for the succeeding years indicated in large figures with each lamp outline until the big Mazda lamp 50 feet high bursts forth in a scintillating blaze to indicate the flood of light which is now made possible by the company's improved service.

While this is going on the torches on either side are burning in a realistic manner and the border lights in different colors are constantly running back and forth along the outlines.

The lamp outlines grow from the baby lamp to the 1913 size twice, while the story is being told on the motograph. The use of colored lamps in the border make the appearance of the flaming torches intensely realistic and the entire sign is one of the most striking electric displays which the Federal Sign System (Electric) has produced.

Electric Service Booklet.

The Sheboygan Railway & Electric Company has issued a booklet entitled "Convenience and Economy of Electric Service." The heading inside indicates that it contains facts worth knowing about electric service and it does indeed contain many items of value for general information. It is designed to cover questions most frequently asked employees and points out with the assistance of illustrations the advantages of electric service. Instructions are given for reading the meter, how to make a meter test by loading the meter with a definite wattage in lamps, the province of the Railroad Commission of the state in regulating service and rates, and how bills may be checked up. Illustrations in color are given of the various types of bills sent to residence customers, commercial lighting customers, power customers, flat-rate customers, etc., and instructions are given for economizing in the consumption of current. The procedure for making application for electric service and having wiring done are stated and the schedule of rates for service of various kinds is listed. The operating rules of the company are then given and are followed by an illustrated description of current-consuming devices, which may be used upon the company's lines. The booklet was prepared by W. B. Voth, superintendent of light and power.

New Trademark of Louisville Company.

In announcing the adoption of a new trademark, the chief feature of which is the slogan, "Your Partner," the Louisville Gas & Electric Company has made an interesting announcement to the public regarding the mutual interests of the corporation and the people. Among other things it said: "The new trademark of the Louisville Gas & Electric Company will stand for a service, rendered in the spirit, not of exploitation, but of partnership.

"Not only shall this trademark stand for service of the highest grade at prices far lower than those prevailing throughout the country, but it also represents service pleasantly and courteously rendered.

"It shall represent a service for all the people, recognizing no lines of party, race, class or religion—the same grade of service for the humble cottage as for the mansion, charged for without discrimination, according to the same low-rate schedule.

"Our new trademark is intended to symbolize a broad, fair and constructive interpretation of the relations which should prevail, and which can prevail, between the public and the Louisville Gas & Electric Company.

"Time and experience are necessary to put vitality into this trademark. Our best efforts and your friendly co-operation will be needed.

"The people and the Louisville Gas & Electric Company are partners."

High Record Output of Minneapolis General Electric Company.

The Minneapolis General Electric Company's output of electrical energy for the week ending November 21 was the highest ever recorded by the company, being 2,226,439 kilowatt-hours, a gain of 34 per cent over the corresponding week of last year. The peak load on Tuesday, November 18, was 23,140 kilowatts, five per cent greater than the previous high mark.

Two Large Contracts in Pittsburgh.

The increasing confidence of the public central-station service in Pittsburgh, Pa., is strikingly illustrated in the recent closing, by the Duquesne Light Company, of two important contracts which will shut down the private plants of the Kaufmann Department Stores Company and the Joseph Horne Company, representing an investment of more than $150,000 and substituting therefor central station service. The Kaufmann plant consisted of 2,000 horsepower in boilers and five 200-kilowatt 110-volt direct-current engine-driven generators. The contract not only covers this capacity but the increased demand due to the additional buildings recently erected. A substation is being built in the basement at the Smithfield Street and Fifth Avenue corner, which will be equipped with three 500-kilowatt 11,000/220-volt transformers. The lighting service will be taken directly from the transformers while the 550-volt direct-current motors will be fed from two motor-generator sets of 300 kilowatts and 200 kilowatts capacity. The station will be fed at 11,000 volts.

The Joseph Horne plant consisted of 700 horsepower in boilers and too steam-driven sets of 200 kilowatts and 100 kilowatts as well as four 50-kilowatt gas engine sets. These have been replaced by central station direct-current supply at 120 volts. High-pressure steam for kitchens and soda fountain is also supplied by the Duquesne Light Company.

New Business at Louisville.

The recent consolidation of the public utilities of Louisville, Ky., under the corporate name of the Louisville Gas & Electric Company, has entailed practically a complete reorganization of the various departments of the company. Particularly in the new-business department has the need for reorganization been felt since under the consolidated company the strenuous competitive policies, especially of the two large gas and electric companies, had to be abandoned for one harmonious policy looking to the rendering of the best possible service.

This task of organizing a commercial department fell to E. L. Callahan, new-business manager of H. M. Byllesby & Company, of Chicago, who control the Louisville company. One of the first changes effected was the moving of the commercial department from the second to the first floor, near the main entrance, so that customers and others having business with this department would not be required to wander about the building to find the employee desired.

Another of the changes made was the discontinuation of selling appliances, motors, etc. The electric appliances formerly carried by the company have been sold to the local contractors and in place of the merchandise display maintained by the company, five contractors have individual displays in glass cases (furnished by the company) in the front of the company's office. These displays are in charge of the company which demonstrates the appliances and takes orders for the contractors. A display of gas ranges, heaters and other appliances (furnished by the agents) is also exhibited.

One of the first large contracts closed since the merger, was one with the United Electric Light & Power Company of New Albany, Ind., covering the sale of electricity to the latter on a wholesale basis, starting with 500 kilowatts demand which is expected later to be increased to 1,000 kilowatts. The New Albany company, which is one of the Insull properties, serves the cities of New Albany and Jeffersonville and an electric railway system with electric light and power. The contract is for a five year period and is attractive from the standpoint of both companies. Necessary apparatus to complete arrangements for serving this load is being ordered and connection will be made shortly after January 1.

A survey of possible business made by Mr. Callahan, indicates a large amount of new electrical business available, most of which it is anticipated will be secured within a year. It is possible that within this period 10,000 horsepower of new business, including both light and power, will be added to the lines of the company.

Denver Company's Christmas Campaign.

Probably to a greater extent than ever before the public in general has come to look upon electrical appliances as suitable Christmas gifts and the holiday season of 1913 will undoubtedly establish a record in this respect. Central stations have finally realized that they must enter into active competition with merchants in other lines and resort to the same aggressive merchandizing methods. The activities of the Denver (Colorado) Gas & Electric Light Company in promoting the sale of electrical Christmas gifts may be considered as indicative of the tendencies in this connection.

Appreciating the attractiveness of bargains the company made special prices on some of the more popular appliances and sent out a series of circular letters calling attention to these reductions. An attractive holiday booklet setting forth the merits of many appliances suitable as gifts was also distributed to all customers. A special feature of this booklet is the offering of appliances in selected groups at very attractive prices, considerably below the regular price if the articles were purchased separately. About 20 different groups are presented, ranging in price from $75 for a washing machine, gas range and water heater, to $9 for an electric iron, toaster and waffle iron. The company will extend credit wherever desired and also makes delivery at any specified time.

House-Wiring Campaign in Louisville.

According to investigations by the Louisville, Ky., Gas & Electric Company, four-fifths of the residences of that city are not electrically lighted. This fact has been made the basis of an effort for new business, a special house-wiring campaign having been put on foot under the direction of E. L. Callahan, new-business director of the Byllesby companies. It has been concluded that while competitive conditions existed in Louisville for a number of years, the competition was for business already existing, and not of a constructive nature. The plan under which the work will be handled is for the company to arrange for the installation of wiring and fixtures, collecting for the work in twelve monthly payments, which will be made with the payment for lighting service. Large space in the newspapers has been taken to announce the details of the campaign, and the force of solicitors has been added to. The campaign will be continued indefinitely, in view of its large scope.

Denver Service.

Following the severe snow storm which swept Colorado during the first week in December and tied up transportation lines, the following appeared in the issue of the *Denver Post* for Monday, December 8, under the heading, "In Appreciation":

"For the people the *Post* wishes to express their thanks for the very excellent and uninterrupted efficient services of the gas and electric and telephone companies during the storm."

License for Electrics Only.

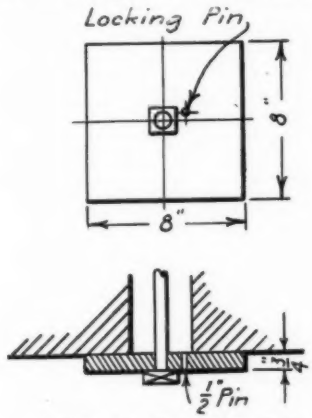
The police department of Berlin, Germany, has refused to issue any more licenses to gasoline-driven cabs on account of their menace to the public health. In the future licenses to operate on the public streets will be issued to electric cabs only.

The City Council of Granite, Okla., has done away with the flat rate for users of electricity from the city plant and will require meters after the first of the year, which must be installed at the consumer's expense.

Electrical Construction

Wrought-Iron-Plate Foundation Washers for Electric Machines.

In cases where it is necessary for an electrical worker to construct a masonry foundation and mount thereon a generator or a motor, foundation washers for the bolts can be readily made from wrought-iron plate, as shown herewith. The standard cast-iron washers are probably preferable when they are available, because they are usually the cheaper. However, it is frequently the case where a machine is installed in an emergency or in a small town that the cast-iron washers can not be secured. It is then that the wrought-iron washer described,



Washer for Foundation Bolt.

which can be cut from a piece of scrap plate, is useful.

The illustration shows a washer for a seven-eighths-inch bolt. For smaller bolts the washer can be correspondingly lighter. A safe rule is to make the length and breadth of the washer equal to about ten times the diameter of the foundation bolt. The thickness of the washer should be equal to at least the diameter of the bolt. The proportions just given apply specifically where the foundation bolt is set in a foundation hole (as shown) having a diameter considerably greater than the diameter of the foundation bolt. Such holes are frequently provided so that the bolts can be shifted slightly to insure that they will enter the holes provided for them in the machine bedplates. Where foundation bolts are to be built in solid, the length of each of the sides of the washers need not be greater than five bolt diameters.

The one-half-inch pin shown in sketch is provided to prevent the bolt from turning when the nut at its top is screwed on. Where the bolt is built in solid, this locking-pin can be omitted. A small machine bolt, a piece of iron rod or a spring cotter may be used for the locking pin. Gerald D. Thomas.

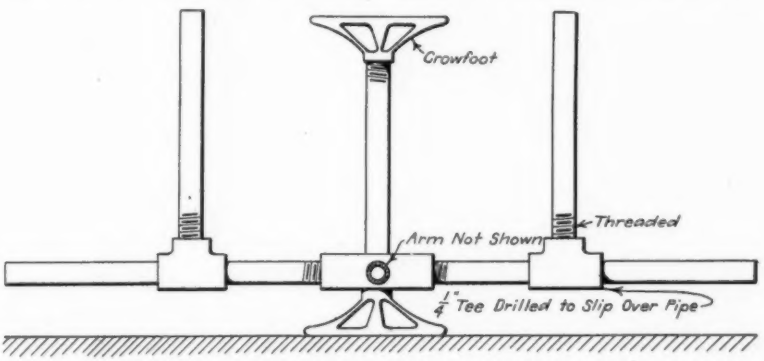
Electric Means for Making Self-Ushering in Theaters Practicable.

A patent has just been granted in this country to Andreas Forster & Hans Wanek, of Vienna, Austria, for an ingenious but very simple means for making practicable the location of seats in a theater or opera house by the audience without the aid of ushers. The scheme is merely to place in the back of each seat and closely adjoining the number plate a small electric lamp so arranged that when lighted it illuminates the number, but is so protected that the spectator leaning against the back of the chair does not harm the lamp, since the latter is entirely inclosed and countersunk in the chair back. The circuit for this lamp is so arranged that when the seat is turned up, as it usually is before the audience enters, the circuit for the lamp in that chair is closed. A master switch controls all of the individual circuits.

Thus, when the theater is thrown open, say a half hour or so before the commencement of the performance, the master switch is closed, thus lighting up all of the individual lamps in the chairs. As the auditors appear only a few head ushers are needed to guide them to the correct passages and knowing the number of the row they can readily locate the seats corresponding to their tickets without needing special ushers to point them out. As soon as the seat is turned down the lamp goes out. This scheme is believed to be particularly valuable when a spectator arrives at the theater shortly after the performance has actually begun, when the theater being dark there is considerable difficulty in finding exactly which seat has been reserved for him.

Reel for Lamp Cord.

Much time is wasted by wiremen and others in untangling lamp cord from loose coils. The accompanying illustration shows a reel which we use in our shop and which has well repaid the time consumed in making it. Take a four-arm fixture body and screw into it four quarter-inch iron pipe nipples of equal length. Drill out the quarter-inch stem-pipe-thread-hole so that a piece of quarter-inch pipe will slip through it; screw this stem into a crowfoot and put another crowfoot on top for a handle. Then thread four quarter-inch nipples for a length of one inch and screw these into quarter-inch common iron tees which have been drilled out to slip on the arms. These uprights can be set to take any size of coil by means of a set screw or by using a pair of gas pliers to screw the vertical pipe down against the horizontal piece.



Construction of Reel for Lamp Cord.

We have about ten of these reels in our shop; one for every kind of cord, which is dropped over the reel when it comes from the dealer. The size of the coil may and actually does vary with almost every shipment. After a trial, one would never be without these reels, as they can be made out of the materials found in almost any shop.

E. M. Raetz.

Stock-Keeping and Buying.

In the majority of electrical businesses so great a variety of goods have to be kept that it is almost an impossibility for the manager, single-handed, to attend to the buying necessary to keep the stock at a proper working level. Consequently in some contracting and factoring businesses there are two or more people who have the matter of stock-keeping in hand. In others it is left to the manager and the storekeeper, the latter of whom is prone to rely to some extent upon his assistant. Usually the storekeeper is supposed to report to the head of the department concerned when the stock of any particular article is running low, and in course of time information drifts through to the manager, if he attends to the purchasing, who gives the matter attention. Such a method of working is slipshod in the extreme; it leads not only to delay in executing work, but to passing on blame from one to another, with the result that there is constant friction between the parties concerned, with a resultant loss of efficiency.

In the contracting business, with which the writer had many years' experience, one of the greatest difficulties experienced is that of keeping sufficient stock in hand to meet all requirements without overstocking; to so arrange matters that an unexpected and important contract could be dealt with, if necessary, the moment it is obtained, and yet avoid tying up capital unproductively in stock that might depreciate in both quality and value. It is true that nothing of a perishable nature is used in the electrical business, but there is always the risk of some suitable line of accessory being placed on the market of which the firm could not make use by reason of a heavy stock being held of some similar but higher priced article. Should that ever be the case, money has been lost as surely as though it had been thrown away. If a certain amount of cable to the value of, say, $500 is in stock, and by reason of metal price fluctuation and a combination of other circumstances a similar quality is to be obtained, an equal amount of which would only cost, say $400, there has been a loss incurred due to overstocking which is very real and important. With that system which is largely in vogue of only going through the stock when the traveler of some large wholesale house makes his periodical call, there is a risk of running short in the intervals, and a further risk of forgetting to order a supply of something which may shortly after be urgently required.

Generally in small businesses there is a rule that whoever takes goods from stock must report when the supply is getting short. Such instructions, although apparently positive, are really vague and indefinite. In a little while the business of reporting shortage will become nobody's business, and whoever is blamed for any mistake that should occur, will have a ready answer to the effect that he thought the deficiency had been reported by someone else. And in either a contracting or a factoring business shortage in stock may have serious results, as not only are immediate profits not realized as they should be, but time elapses before work can be done or deliveries made. In the former case an undue proportion of overhead charges has to be borne by the contract, and in the latter customers are dissatisfied by the delay, which means loss of future custom.

The first step to be taken towards adopting a scientific system of stock-keeping, is to make out a list of what constitutes a normally sufficient stock. To draft this properly a good deal of work will be necessary; the records of the stock-room and of the ordering department must be gone into closely, and as accurate a statement of the needs of the business as can be prepared must be drawn up. In this list nothing should be included that can be considered as being superfluous; nothing taken into account that can be purchased readily at a fair price immediately it is required. Yet the list should be thoroughly comprehensive, and kept ready for immediate reference so that any new accessory that became obtainable and that could be used by the firm with advantage could be added. The list, when drawn up, should be open to the inspection of every member of the staff who is interested in the subject of stock, so that they could at any time see what should be the normal amount of any particular goods.

Having drawn up this list, the next step to be taken is to prepare cards, or a loose-leaf book devoting one card or one page, as the case may be, to each item. This record must be kept up by the storekeeper, who should enter thereon every movement, outward and inwards, of the goods. The cards should show the normal stock, according to the list mentioned above, the amount of stock in hand at any particular moment, when the last purchase was ordered and delivered, and the name of the firm from whom it was obtained. Every week (as a longer interval increases the risk of running short) these cards should be brought by the store-keeper to the manager or buyer, who enters the totals on a set of master cards, divided into weekly spaces. These master cards can contain, preferably entered on the back, a good deal of information not usually kept on a card system, such as the names and addresses of other firms from whom supplies can be obtained, the prices which they would charge, and the time they would take for delivery. The advantage of this is that in the event of a sudden call for stock which the regular suppliers could not execute immediately, other firms could be approached at once without it being necessary to look up old quotations. The cards should also contain a record of all goods on order, with the order number and date and any other information which the exigencies of the business might render it advisable to keep.

It is true that when this system is adopted there is a temptation for a storekeeper to take stock from the cards instead of from the actual bins of goods. Proper supervision will easily prevent this, however. But when the system is carried into practice, it will be found to facilitate greatly the work of preparing an approximate statement of profit and loss each month. Of course, such a statement can be only approximate, as the total purchases cannot be arrived at until the ledger department has received all invoices and they have been properly passed. But if the cards are accurately kept and the stock is taken periodically, and independently of the card records, the two can be checked together, when it is an easy matter to arrive at a statement that should not be out more than a few dollars either way.—*Electrical Industries.*

Licensing Wiremen in Australia.

In Sydney, New South Wales, the City Council has taken a definite stand in the matter of licenses and has approved a scheme for the appointment of a Board of Reference in connection with installation work. The Board of Reference is to be composed of one representative each from the central station, contractors, fire offices, Electrical Trades Union, and Electrical Association of New South Wales. It is further proposed that the Council make by-laws to the effect that connection with the mains will not be permitted in cases where the installations are not approved, or where such installations have been carried out by firms or persons not approved by the Council; that where a person or firm has been recommended by the Board of Reference as competent to carry out the work, this recommendation shall be sufficient evidence for the Council to give its approval to such firm or person.

In Victoria, the subject has been prominently before the Electrical Traders' and Contractors' Association and the Victoria Institution of Electrical Engineers, but no definite action has been taken.

In Dunedin, New Zealand, the licensing of wiremen is in effect, and the city electrical engineer reports that the standard of workmanship has been improved, as also has the status of the men.

Unsafe Wiring in New York City.

An investigation conducted by the New York Electrical Contractors Association has disclosed so alarming a number of buildings which are unsafe because of faulty electrical equipment that the or-

ganization is planning to ask the Board of Aldermen for an ordinance imposing more stringent regulations upon owners. The investigation has shown that nearly 500 buildings in New York, including hotels and apartment houses as well as business structures, are in the "unsafe" class, placed there by the fire underwriters, and that there is no way to enforce improvements.

Officers of the association have applied to the New York Board of Fire Underwriters, but have learned that the underwriters have no power to act. When a building is found to contain faulty equipment the fact is reported to the underwriters, who in turn notify the owner. He can do as he likes about the request that he correct the trouble. If he fails to do this the company that insures his place usually threatens to raise his rate, but the rate in most cases is not raised, at least until the end of the three-year period for which most buildings are insured.

Sometimes owners prefer to pay a rate increase from 10 to 25 per cent rather than make the needed improvements.

New York City to Have New Fire-Alarm Boxes.

It is announced that a non-infringing fire-alarm box has been developed by Leonard Day, chief of the Fire Alarm Telegraph Bureau, and E. A. Faller, telegraph expert of the Fire Department of New York City, and has been dedicated to New York City without royalty. It is expected that the cost under competitive bidding will not exceed $45. The price of fire-alarm boxes during the past seven years has run from $75 to $175 each.

During the present administration of the Fire Department of New York City, more than a million dollars' worth of new construction work has been completed, including underground cable which is being installed in a systematic manner, and as a part of a completely developed scheme for the several boroughs of the city. The operating features of the new fire-alarm box contemplate the elimination of a great deal of work and a considerable elimination of damage in detecting and testing for breakdowns and provides for the use of the new cable system.

Load for Meter Testing.

To arrange a portable load for meter testing I took from some old flat-irons the 500-watt heating units and connected them in parallel in a box, each being controlled by a snap switch. There was also a 16-candlepower lamp controlled by a switch. The box is lined at the ends and top and bottom with asbestos, while on the sides there is a fine wire screen for ventilation. As the current is never on for a very long time the coils do not heat up to an undesirable extent.

By using the different coils I get sufficient load for a full-load test of the meter, since with four coils I can use 500; 1,000; 1,500; or 2,000 watts. This serves to test meters up to 20 amperes in capacity. The lamp takes about 50 watts and is used for a light-load test. This serves very well for a large percentage of our meters, as we have a great many which do not exceed 20 amperes in capacity. Of course it can only be used on 110 volts.

Leland K. Brown.

Formulas for Flux and for Solder.

The following fluxes will be found desirable to use for soldering and welding various metals. For steel and iron use sal ammoniac or borax; for zinc use chloride of zinc; for lead use tallow or rosin; for brass use sal ammoniac or sulphuric acid.

The best solders for different metals are as follows. For lead, use two parts tin and three parts lead; for tin use one part tin and two parts lead; for aluminum-bronze use four parts copper, four parts zinc and three parts borax; for aluminum-brass use 70 parts copper, 30 parts zinc and 5 parts aluminum; for bronzing use half copper and half zinc.

William E. Rhodes.

Foreign Markets for Electrical Wiring Supplies and Appliances.

In response to a suggestion from the Bureau of Foreign and Domestic Commerce there have been received at Washington, D. C., reports from nearly 25 American consuls stationed in 17 foreign countries respecting the prospects for creating a market in their respective consular districts for electrical wiring supplies, devices and appliances of American manufacture. These reports were published in the November 26 issue of the *Daily Consular and Trade Reports*, which is issued by the Bureau. Since these reports cover nearly 27 pages in that issue, it is impossible here to more than merely call attention to them in the hope that manufacturers and exporters interested will study the reports in detail.

The reports deal with twelve European, three Asiatic and two South American countries. In none of these apparently do the wiring regulations call for as high-class material as is customarily used in this country. Building construction is of a much more massive and conservative type; structural steel is but little used in buildings and in practically no other country can buildings exceed five to at most eight stories in height. Surface wiring or molding is generally used. Wiring supplies, fittings, etc., are of cheap and flimsy character in many places. In Palermo, Italy, for instance, German keyless sockets are sold for 3.2 cents and switches for 4.8 cents and these prices are further reduced by small discounts for cash in 30 days. In most of the countries reported on, the German manufacturers absolutely control the market on terms that make competition practically out of the question. In other countries, however, where requirements are somewhat more severe and where quality is appreciated, there are opportunities for developing a demand for American electrical goods. In any case, the market must be carefully studied and an active representative preferably be secured to introduce and push the sale of the goods. Catalogs without samples are almost wasted and particularly when in a language that the prospect does not understand.

Among the Contractors.

C. N. Croneweth, of Pittsburgh, Pa., received the contract for the residence of D. N. Carbun.

John H. Pfenninger has recently established an electrical contracting business at 606 West Chestnut Street, Lancaster, Pa. Mr. Pfenninger has had a number of years of practical experience and has a large local acquaintance in Lancaster.

K. D. Slocum, of Clinton, Iowa, has been awarded the contract for the wiring in the new Orpheum Theater of that city.

The Voggley Electric Company, Tarentum, Pa., has been awarded the contract for a new church being erected by the Central Presbyterian congregation.

Carter Electric Company, Pittsburgh, Pa., has the contract for the engine house being erected at North Homestead by the city.

F. Hennan & Son, Crafton, Pa., has the contract for the residence being erected by Coleman Murphy.

Stough & Lucas, electrical contractors of Lancaster, Pa., have been awarded the contract for the installation of the entire plant, including two generators, switchboard, motors totaling over 450 horsepower, and all necessary wiring, in the new plant of the Baltimore Roofing & Asbestos Products Manufacturing Company, at Asbestos, Md.

Loom Clamps Required in Detroit.

Beginning on January 1, the city of Detroit, Mich., will require the use of circular-loom clamps on all installations of knob-and-tube wiring.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Hanging a Fixture.

To hang a shower fixture, first screw up the crowfoot or insulated joint; then take a ¼-by-⅛ bushing and a short piece of ⅛ pipe about a foot long with a thread on each end; screw these together and then screw into the crowfoot or joint; slip on the fixture and a small piece of rubber packing to prevent scratching the pan. A ⅛ locknut is screwed on the end of the pipe. This will hold the fixture until the connections are made, soldered and taped. After this is done the pipe can be removed and the fixture is ready to put in its proper position.

A. De Groot.

To Ignite the Torch.

To light a torch conveniently and without using matches I have adopted the following scheme. The tank of the torch is connected by flexible cord through a spark coil to one side of a 110-volt circuit. From the other side of the circuit a line is taken through a 100-watt lamp and brought to a contact over the bench. When the spout of the can alongside the wick is touched to this contact, a spark results which will produce ignition. To prevent a shock the handle of the can is taped.

William T. Estlick.

Lamp Changer.

Having to change some lamps in a fixture in a church auditorium and not having time to order a lamp changer, I proceeded to make one. From a lumber yard I got two strips ⅞ by ⅞ by 12 inches. At a nearby garage I bought two old automobile horn bulbs. A piece of tin was bent into the form of a socket holder similar to that used on jointed fishing poles. This was fastened to the end of one of the strips and the other was made to fit into it. One of the horn bulbs was cut through the middle and the reed end was fastened to the end of the pole by winding with wire. The other bulb was split in four sections and these lips turned in to hold the lamp. The second bulb fitted tightly into the first. The lamp changer complete is shown in Fig. 1.

J. C. Walsh.

Fishing Wires in Fixtures.

An improvement over the usual method of fishing wires in fixture arms illustrated in the issue of November 15 is to use small piano wire, looped, in place of the bare copper wire. The trouble in using a single copper wire is that the place where the copper wire joins the conductor catches on every sharp corner. With both the lead wire and the conductor looped you can pull around any corner. I use piano wire because it slips around the corners more easily and does not get ragged on long pulls.

Clement McPhee.

Fig. 1.—Improvised Lamp Changer.

Fig. 2.—Fishing Wires in Fixtures.

Light for Horse-Shoeing.

To give proper light for horse-shoeing, lamps should be placed about 20 inches above the floor line. The lighting can be conveniently arranged by procuring a tin dish pan for each lamp. Cut two holes in this for a piece of loom and use porcelain sub-base and wall socket with a 40 or a 60-watt lamp. A hole is cut in the wall and the pan is set in until its outer edge comes flush with the wall. This protects the lamp from the likelihood of being struck by either horses or men.

J. C. Walsh.

A Convenient Fault Finder.

The device illustrated in Fig. 3 is one that is very convenient in locating breaks in an electric circuit. The testing set consists simply of a cheap door bell and a portable telephone receiver.

I am using a test like this on fire-alarm circuits 10 or 15 miles long. When I go out to look for an open circuit, I connect up the bell as shown and then, in the neighborhood of where the break is thought to be, I connect one side of the telephone to ground and the other to the line. Silence in the telephone is an indication that the break has been passed, of course, while as long as the telephone is between the break and the bell there will be a humming noise in it, the arrangement being such that the vibrations of the bell clapper interrupt the current, from the battery and re-establish it.

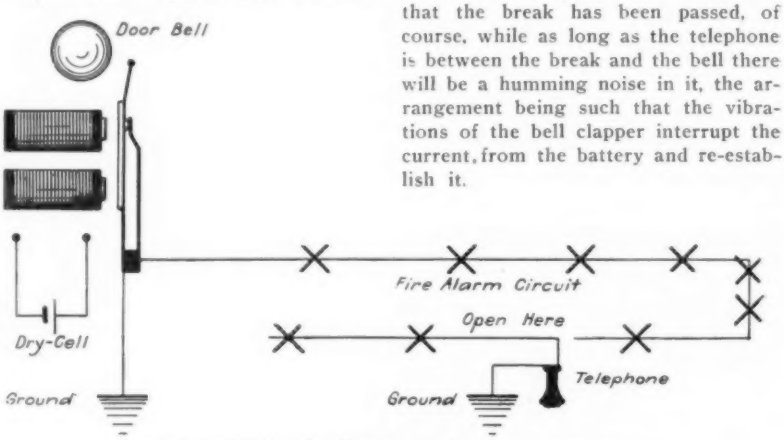


Fig. 3.—Testing for Faults with Bell and Telephone.

The beauty of this sort of test is that it does not need any battery or generator out on the line to close the circuit, as does the hand-generator or battery test.

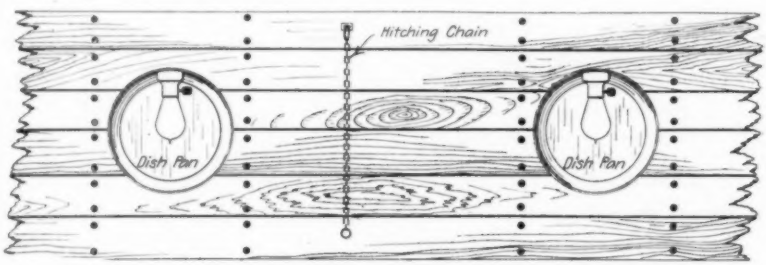


Fig. 4.—Mounting of Lamps for Horse-Shoeing.

The crosses in the line in the diagram, represent the arrangement of the fire-alarm boxes in the circuit.

J. L. Jelley.

New England Vehicle Meeting.

A meeting of the New England Section, Electric Vehicle Association of America, was held at the Edison Building, Boston, December 18, Chairman J. A. Hunnewell presiding. Chairman J. S. Codman, of the Meetings Committee, announced that the committee planned to hold the January meeting in Salem as the guests of S. Fred Smith, of the Salem Electric Light Company. Other meetings planned are to be held at one of the large truck-using centers of New England, another at the Lynn plant of the General Electric Company, and two others in Boston.

C. J. Hatch, chairman of the Membership Committee, explained the organization of this new committee as consisting of a general chairman, a state chairman for each of the New England states, and two associate state members. A campaign will be waged among central-station men. E. S. Mansfield suggested that a correspondence course in electric-vehicle practice be established by the Section, and it was voted to refer the matter to the Educational Committee.

Charles F. Smith, head of the garage of the Boston Edison Company, then gave a stereopticon lecture on the new garage of the company.

It was asserted by a British electrical engineer in a recent address at Newcastle that the waste heat and waste gases from coke ovens and blast furnaces in the United Kingdom was sufficient to supply the entire demand for electricity throughout the Kingdom.

Public Service Commissions

CALIFORNIA.

A decision was rendered by the Railroad Commission granting authority to the Mt. Whitney Power & Electric Company to issue $250,000 of bonds.

MARYLAND.

The Public Service Commission of Maryland, has directed the Edison Electric Illuminating Company, of Cumberland, Md., to reduce its rates for electric current for commercial lighting and power purposes. The reduction shall be equivalent in the aggregate to 15 per cent on the gross revenues of the company derived from supplying such service. The order will become effective February 1, 1914.

MASSACHUSETTS.

The Gas and Electric Light Commission has approved the regulations and restrictions imposed by the Selectmen of the town of Norwood in granting a location for a transmission line to the Edison Electric Illuminating Company of Boston under the highways in Norwood, this line to form a connection between the Edison Company's line in Westwood and its lines in Walpole. The regulations provide that the work shall be done under the direction and to the satisfaction of the Selectmen; and that the company shall keep the streets properly protected while the construction is going on. A bond is required to the amount of $10,000 for the faithful performance of the work.

OHIO.

The Public Utilities Commission has authorized the Wilmington Water & Light Company and the Xenia Gas & Electric Company to sell their properties to the Dayton Power & Light Company and wind up their existence as separate corporations. The Dayton Power & Light Company has been authorized to issue five-per-cent bonds in the amount of $125,000 and six-per-cent cumulative preferred stock to the amount of $50,000, these securities to be used in payment for the property of the Wilmington Water & Light Company. In addition, current obligations of the latter company to the amount of $3,700 are to be taken over by the Dayton company. The purchase price for the Xenia Company was $275.

The Commission has changed the minimum price for the sale of the preferred stock of the Northern Ohio Traction & Light Company, previously fixed at par, to 95 per cent thereof.

OKLAHOMA.

A proposed order has been issued by the Oklahoma corporation commission regulating charges for moving or exchanging any telephone, electric, gas or water meter. Companies affected are notified to appear before the commission on January 13 to enter any protests that they may have in regard to the proposed order.

INTERSTATE COMMERCE COMMISSION.

The annual report of the Interstate Commerce Commission will show that the work of the Commission is increasing rapidly in all its branches and to such an extent that it has become almost impossible for the Commissioners to personally undertake investigations at other points in the country, thus making it more and more necessary to place these investigations in the hands of competent special examiners. During the past fiscal year 7,600 informal complaints were received; 6,730 applications were received from carriers for authority to make refunds to shippers of amounts which, for one reason or another, had been illegally collected; 1,252 special applications were received for relief from the provisions of the Fourth Section; 159 investigation and suspension proceedings were instituted during the year; 1,023 formal complaints were filed, an increase of 268 over the previous year; during the year 724 formal complaints were decided and 139 dismissed.

A great deal of work is being done in the accounting division, among which has been the issuance of the "Uniform System of Accounts for Telephone Companies," effective January 1, 1913, embodying classifications of capital expenditures, operating revenues, operating expenses, and balance sheet, income, and profit and loss statements. The rules have been prescribed for the use of telephone companies having operating revenues of more than $50,000 per annum. It is expected that the needs of smaller companies will be met by prescribing a simpler system.

A system of accounts for telegraph and cable companies has been completed and will be made effective January 1, 1914. The remaining classification to complete the systems of accounts for electric railways, express companies, and sleeping-car companies are still in preparation, substantial progress having been made during the year. The orders for the destruction of accounts have been issued applying to electric lines. The Commission also has in course of preparation orders for telephone, telegraph and cable companies.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 175.—Two-Rate Meters.—Has any American central-station company employed two-rate meters for residences and other small customers connected to its miscellaneous lighting circuits? What method is used to change from the low rate to the high rate during the time of peak load and back again? What effect has this had on the peak? Is the time of high rate adjusted during the different seasons to correspond with changes in the station peak? Does the two-rate meter eliminate the need for primary and secondary rates based on maximum demand? What is the relative cost of a 10-ampere, two-rate induction meter compared with a similar standard meter?—V. P. B., Milwaukee, Wis.

No. 182.—Searchlights.—Is a yellow-colored searchlight beam more penetrating on a foggy night than a white beam? What is the greatest distance that a searchlight has been seen on a clear night?—W. M. L., Baltimore, Md.

No. 188.—Purity Test for Sal Ammoniac.—I would like to know a simple but accurate way to test sal ammoniac. I find that considerable of this material being sold is adulterated with common salt or other cheap chemicals. The burning test is not accurate enough. I would like to be able to test about what percentage of the test sample is pure sal ammoniac and how much of it is adulterated.—F. H. W., Brooklyn, N. Y.

No. 189.—Number of Outlets per Circuit.—In the December 20 issue of the Review I see mention of a rule in Cleveland regulating the number of outlets per lighting circuit. Like most rules on this point it restricts the total load to 660 watts and also the maximum number of outlets to 12. Now where a circuit is arranged with nothing but 25-watt lamps and larger lamps could not be used satisfactorily, would it be permissible to run 20 of them on one circuit?—F. N. K., Maywood, Ill.

No. 190.—Vehicle Batteries.—What number of cells is most commonly used at the present time for the storage batteries of electric vehicles? Is there likelihood of standardizing this so as to simplify the charging equipment and raise the efficiency of charging?—P. S. J., Rockford, Ill.

Answers.

No. 183.—Slotting Commutators.—Has the practice of slotting commutators proven to be as valuable as was predicted several years ago? Is it increasing or decreasing in vogue? What is the best tool to use for this purpose?—F. S., Houston, Texas.

Commutator slotting is just as valuable today as it ever was, in fact, this practice in our estimation is more in vogue than formerly. At first this practice was confined almost entirely to railway and other traction motors but in recent years its use has extended to the stationary motor and generator. The slotted commutator is used a great deal on all high-speed direct-current machinery, so much so in fact, that it can be considered as common practice. Many high-speed generators, especially those that are turbine-driven, are supplied by the manufacturer with slotted commutators. The same can be said of many types of railway motors. There are several good slotting tools on the market, and at least six manufacturers in this country make reliable slotting devices.—A. B., Cleveland, O.

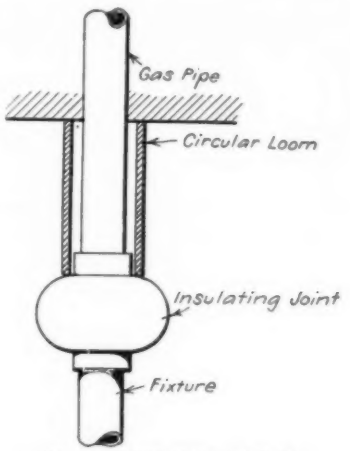
The answer to Question 183 published in the December 13 issue described a slotting tool which I think can be improved upon as follows: Take a piece

No. 183.—Slotting Tool.

of three-eighths-inch gas pipe about 10 inches long and flatten one end as shown in accompanying sketch, about 1.5 inches. Take a hacksaw and saw the slot for the blades in between the two flat surfaces of the pipe. Next drill and tap the flattened part of the pipe for two screws to be used for clamping the blades in the slot. On the other end wrap some rags and then wrap some adhesive tape over these to make a sort of handle to hold it; this will prevent injuries to the palm of the hand. When ready to slot the mica in the commutator first ascertain the width of the slot and grind the hacksaw blade thin enough to just cut the mica and not interfere with the copper bars. If the slot is wider than the hacksaw blade, two blades can be used side by side by first grinding the set out of the teeth on one side of each blade before clamping them together. The hacksaw blade should be about one inch or one and one-fourth inch long so that the screws in the tool will clamp them solid. The blades can be set on an angle, as in the sketch, so that one can work over the commutator which is not as tiresome as when having to slot with a tool that must be worked parallel with the surface of the commutator.—W. T. E., Seymour, Conn.

No. 185.—Loom for Combination Fixture Outlets.—In this city the wiring inspector requires all gas stubs to be loomed in both electric and combination fixtures, instead of using tape as was formerly allowed. How can the loom be secured so that it completely covers the stub and will not work off if the bottom of the canopy does not come in contact with it, as where a deep canopy is used?—R. O., Portland, Ore.

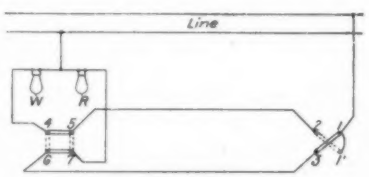
The fixture will have to be equipped with an insulating joint which has a



No. 185.—Insulating Fixture.

larger outside diameter than the pipe. Cut the loom so it will fit snugly, as shown in the sketch herewith, between the ceiling and the insulating joint when this fitting is screwed into place.—R. T., New York, N. Y.

No. 186.—Special Three-Point Switch Control.—A pair of white lamps in a hall is to be controlled by a pair of three-point switches, one at each end of the hall, but instead of turning the lights out a pair of red lamps is to light up when the white lamps are switched

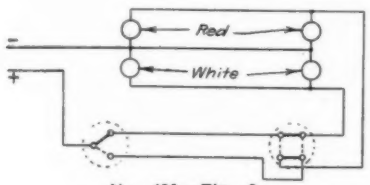


No. 186.—Fig. 1.

off. In other words, when either switch is turned it will merely change the circuit from the white lamps to the red lamps or the reverse, there being no "off" position to the switches. I would like to arrange such a circuit and want to know if it can be done and how?—J. C. M., Del Mar, Cal.

This control cannot be accomplished by using a part of three-point switches. However, by using a three-point switch and a four-point switch, as shown in Fig. 1, it can be wired easily. These are both standard switches. The three-point

switch shown on the right has points *1* and *1¹* permanently connected by a jumper; the position of this switch shown connects *1* to *3*; the alternate position (shown dotted) connects *1* and *1¹* to *2*. The four-point switch shows points *4* and *5* connected and also points *6* and *7*; the second or dotted position of this switch connects *4* with *6* and *5* with *7*. It will be found that turning either switch changes the current from the red to the white lamps and the reverse. Although only one red and one white lamp are shown, it is evident that two or any number can be wired in parallel so as to be controlled together. By inserting another four-point switch between the switches shown the lamps can be controlled from three points equally well; in this case two diagonally opposite points must be connected to the switch

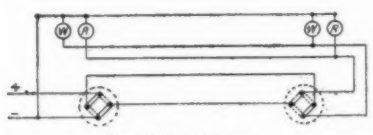


No. 186.—Fig. 2.

on the right and the other two to the switch on the left.—C. J. B., Delphos, O.

Your questioner specifies that two pairs of lamps in a hall-way are to be flashed alternately by "two three-point switches." I assume that results are more important than type of switch and accordingly suggest the use of one three-point (or two-way) switch, and one four-point (or reversing) switch, wired in combination, as shown in Fig. 2. It should be understood that these switches must be of the standard "snap" type, either surface or flush, in order to avoid possibility of being left in the "off" position whilch would be possible if knife switches were used.—H. A. Calderwood, Pittsburgh, Pa.

[Similar answers from C. W. G., Kal-



No. 186.—Fig. 3.

kaska, Mich.; R. T., New York City; V. S., Portland, Ore.; and C. R. W., Knoxville, Tenn.—Ed.]

In the diagram herewith (Fig. 3) is shown how this can be done with two four-point switches. Operating either switch controls the red and white lamps alternately. I don't believe it can be done with three-point switches.—F. W. B., Chicago, Ill.

No. 187.—Wiring in Packing House.—I want to install the most approved system of wiring and up-to-date material in a packing house with very damp rooms and cellars. Which is best—iron-pipe conduit, lead-covered cable or flexible-steel conduit? It seems to me lead-covered cable would be best, as water can hardly be kept out of conduits and causes untold trouble. I should like to hear from some readers that have had experience in such work.—J. McQ., Cincinnati, O.

Lead-covered cable would no doubt be the best material to use in locations where dampness exists, but if the best construction possible was desired why not use lead-covered cable installed within rigid iron conduit? The conduit runs should be arranged so as to have a certain pitch at every point towards an outlet box, thus making it impossible for water to collect within the conduit. Also, where the supply wires are split to attach to fixtures, carefully cover each conductor with a layer of rubber tape extending to the point where the lead covering begins, then put on two layers of good-quality friction tape and over all apply, say, two coats of good-quality moisture-proof compound.—W. A. M., Cold Spring, N. Y.

Hospital Lighting.

In the Electrical Review and Western Electrician of November 29 there appeared an illustrated article entitled "Electricity in Hospitals." An oversight in the preparation of this article neglected to give credit to Mr. W. S. Kilmer, engineer of the electrical department of H. W. Johns-Manville Company, for considerable data used in connection with the subject of ward and operating-room lighting. Mr. Kilmer has given this matter a great deal of earnest research, and should be credited with much of the advance which has been made in recent years.

Electrical Companies Win Awards at Exposition of Safety and Sanitation.

The Jury of Awards in its presentation of prizes to various participants at the First International Exposition of Safety and Sanitation, held in New York last week tendered prizes among others, to the following electrical companies: Brooklyn Rapid Transit Company, New York Telephone Company, Draeger Oxygen Apparatus Company, General Electric Company, National Electric Lamp Works of General Electric Company, New York Edison Company, and Allgemeine Elektricitäts Gesellschaft of Berlin.

New Municipal Plant in Edinburgh.

The municipal electric plant in Edinburgh, Scotland, is incapable of supplying the increasing load, so a new and thoroughly modern plant will be built.

LETTER TO THE EDITOR.

Cancer and Secondary Rays from Calcium Phosphate.

To the Editor:

I have accumulated a considerable amount of evidence to the effect that, where cancer has been cured by radium, the effect has been due to secondary radiation from one of the constituents of bone material. The indications are that the constituent is either calcium or phosphorus.

Of course the proper way to attack the problem would be to determine what wave-length of x-rays is emitted from bone material when exposed to gamma rays from radium, and then to determine what kind of anti-cathode and what hardness of x-ray will produce the same secondary radiation.

At present I fear that this cannot be done, but by embedding a piece of bone material or calcium phosphate in a cancer and exposing it to a pencil of x-rays from a tube with uranium anti-cathode and of the proper degree of hardness, I would anticipate much more favorable and consistent results than those obtained from radium.

Reginald A. Fessenden.

Brookline, Mass., December 1, 1913.

New Engineering Courses at Lewis Institute Evening School.

Beginning with the winter term on January 5, 1914, two new engineering courses will be added to the Evening School of Lewis Institute, Chicago. An additional course in telephone engineering will be given by Fred R. Quayle, engineer Automatic Electric Company. Students taking this course must have at least a good working knowledge of alternating-current principles, since the course will not be elementary. The new course, like other work in telephone engineering, will be under the general supervision of Prof. Arthur Bessey Smith.

On the same evening an advanced course in the engineering of reinforced-concrete construction will be begun. This will be given by Ernest McCullough, the well known consulting civil engineer. This course will involve the design of a ten-story reinforced-concrete building.

The evening classes at Lewis Institute have been steadily increasing. The total enrollment during the past year has been about 2,500 students and it is likely that even this large number will be exceeded in 1914. Prof. P. B. Woodworth is dean of the Evening School at Lewis Institute and will gladly supply detailed information regarding any of the classes.

On December 2 the electric light plant at Gregory, S. D., was destroyed by fire, the loss amounting to about $15,000.

The Limiting Size of Steam-Turbine Units.

In any really large power station the size of the units to be installed is a matter deserving of very careful consideration. In the earlier days of power-station development, great subdivision of the plant was natural, since breakdowns, complete or partial, being somewhat prevalent, security was sought in a somewhat minute subdivision of the plant into relatively small units. In general, however, the cost of providing for a given aggregate output is greater the greater the number of units. For this there are several reasons, but one important factor is that what may perhaps be called the "non-effective" costs of a steam turbine are proportionately very much greater the smaller the unit. The costs in question comprise that of the governor and its gear, the valves, the oil pumps, tachometer, and similar accessories. In the case of a 500-kilowatt unit, the cost of these amounts to about 45 per cent of the total cost of construction, falling, in the case of a 1,000-kilowatt unit, to 40 per cent, and in the case of a 10,000-kilowatt turbine to 30 per cent. Hence, even if the "affective fraction" of a complete turbine cost the same per kilowatt for a small unit as for a large one, the total costs would be more with the smaller sizes. Actually this argument understates the case for the larger unit. In fact, the same casing is sometimes used for a 5,000-kilowatt machine as for a 7,000-kilowatt unit and at the same speed of revolution, so that the turbine costs proper are almost identical, though some saving results from a smaller condenser being required with the smaller output. At the same time, the floor space occupied will be greater the greater the number of units, and in general the efficiency of small prime movers is markedly less than that of larger ones.

To this rule the internal-combustion engine forms an exception, the efficiency attained with an engine of about 60 horsepower being about as high as with an engine ten or twenty times as large. Hence, with stations operated by gas or oil power, an increase of efficiency does not form one of the arguments to be adduced in favor of installing units of large size, the lower limit in such a case being, in fact, fixed wholly by financial considerations. Whatever the agent by which a power station is operated, there is, however, also an upper limit to the size of the unit which it is desirable to adopt. In most cases this is continually being raised by the progress of the engineer's art, but there does appear to be, for the present at any rate, a very definite "mechanical" limit so far as internal-combustion engines are concerned. In the case of a gas engine, for example, it is a deduction from theory, which has been confirmed by actual practice, that the weight per horsepower developed is proportional to the cylinder diameter, so that doubling the size of an engine, though it quadruples the output with the same piston speed, requires the incorporation into the engine of eight times the weight. Moreover, cylinders of very large diameter are subject to extremely severe temperature strains, and it has generally been considered that about 48 inches constitutes the practical limit to the size of a gas engine cylinder. This conclusion may possibly be, however, considerably modified in the future by Hopkinson's method of spraying water into the cylinder.

With some other forms of prime mover the limit of size is far less definitely circumscribed by purely mechanical considerations. Theory shows that such a limit must exist, since all prime movers are, in the ultimate, subject to the law that whilst the output increases as the square of the dimensions, the weights involved increase as the cube. For the present, at any rate, this consideration hardly affects the question as to what is the limiting size of a steam-turbine unit. This is, in practice, fixed by difficulties of transport and by the high cost of exceptionally heavy castings and forgings. If a power station is intended to furnish a three-phase supply at 25 cycles, the turbo-alternator must run at either 750 or 1,500 revolutions per minute. If the former be chosen, the limits of size are pretty definitely fixed by questions of transportation, the loading gauge on British railways restricting the diameter of a drum-rotor over the blades, to about 8 feet 6 inches, and the diameter of a disk to about 13 feet.

An interesting point which then arises is the maximum output possible with rotors of the dimensions stated. This output depends essentially on two factors: the centrifugal stresses and the vacuum obtainable. Condensing plants have been so much improved that with a barometer of 30 inches a vacuum of 29 inches should be realized during a large fraction of the year. Incidentally, it may be observed that the great economy of fuel which results from the systematic adoption of high vacua makes it imperative to fix all large power stations at sites where an ample supply of condensing water is readily available. As delivered from an efficient turbine, however, the volume of one pound of steam at a 29-inch vacuum is of the order of 600 cubic feet, making an average allowance for the wetness of the exhaust steam. If this steam is allowed to have an axial velocity at discharge of 440 feet per second, and the blade length is limited to one-fifth the mean diameter of the blading, the output of the turbine in kilowatts cannot exceed the square of the mean diameter, in inches, of the last row of blades, assuming the very good steam consumption of 11.5 pounds per kilowatt-hour. If, therefore, we assume that the last row of blades is carried on a disk 13 feet in diameter over blade-tips, the maximum output possible from a single-flow turbine operating with a 29-inch vacuum, and with a "carry-over" loss of about 4 British thermal units, would be about 130^2=16,900 kilowatts. By admitting a carry-over loss of 9 units, this output could be increased to about 25,000 kilowatts. If the vacuum were limited to 28 inches, the possible output would amount to about 33,000 kilowatts, with a carry-over loss of 4 British thermal units, and to about 48,000 kilowatts with a carry-over loss of about 9 heat units.

Allowing for a reheat factor of, say, 1.05, the heat available with steam at 200 pounds absolute and 200 degrees Fahrenheit superheat, expanded down to a 28-inch vacuum, is about 391 British thermal units per pound; whilst if the expansion be carried down to the 29-inch vacuum, the corresponding figure is about 428 British thermal units. An exhaust loss of 4 British thermal units amounts, therefore, to about 1 per cent of the total energy available, and one of 9 British thermal units per pound to about 2¼ per cent. To get 33,000 kilowatts out of a single-flow turbine with a 29-inch vacuum would necessitate an axial velocity at discharge of about 880 feet per second, and the carry-over loss would amount to nearly 16 British thermal units. An increase of vacuum from 28 inches to 29 inches would therefore still result in a saving of steam, since the heat available on expansion to the lower limit is about 37 British thermal units more. An attempt to get 48,000 kilowatts out of the turbine with a 29-inch vacuum would, however, be futile, as the "carry-over" losses would be so greatly increased as to cancel almost the whole of the difference in the heat available with a 28-inch and with a 29-inch vacuum.

There would, of course, be no difficulty in running a wheel of the size proposed at 750 revolutions per minute. In fact, experience with the De Laval turbines shows that the speed might be raised to 1,100 revolutions per minute without exceeding limits of stress known to be safe in practice. A 300-horsepower De Laval wheel has a mean diameter of 30 inches, the blades being about 1.25 inches in usable length, and the speed 10,600 revolutions per minute. If every part of the wheel were increased in direct proportion up to a mean diameter of 130 inches, the stresses would be the same as before, provided the revolutions were reduced in the ratio of 30 to 130—that is to say, to 2,440 revolutions per minute. The blade length would then be 5.5 inches. If the length of these blades were next increased to 26 inches, their weight and the stresses in them would be about 4.75 times as great, so that to

bring down the stress to its original limit the speed must be divided by 4.75, being thus brought down to 1,125 revolutions per minute. If the ratio of blade speed to steam speed were the same with the 26-inch blades as with the 6.5-inch blades, the bending stresses produced by the steam which drives them would be the same as before, and the margin of security as great as in the original De Laval wheel. This increase of blade length would, of course, involve a diminution in the size of the wheel disk, so that the total stresses in the latter would be less than they were in the original wheel. By constructing the low-pressure portion of a turbine on the double-flow system the limiting outputs above stated may, of course, be doubled, and hence very great outputs are mechanically feasible in single units.

For the present, however, the practical limit for a turbine running at 750 revolutions is probably about 25,000 kilowatts, and if of the drum type, questions of rail transport make it necessary to construct the rotor for such an output on the double-flow system. The casings are less difficult to deal with, as they can be built up in sections. The total weight of such a turbine would be between 250 and 300 tons, that of the heaviest part to be lifted being between 30 and 40 tons. The sizes of the various forgings required would be, however, about up to the limit of what can now be obtained, and the cost per ton of these very large forgings and castings is very considerably more than those of more moderate size. It is, therefore, perhaps, open to doubt whether units of this size are, save in exceptional cases, more advisable than those of about one-half to two-thirds the capacity in question, running at the alternative speed of 1,500 revolutions per minute. The last row of blades might then have a mean diameter of 85 inches, or a tip diameter of 8 feet 6 inches, and the output, without extravagant losses to the exhaust, might run up to fully 14,000 kilowatts. If of the double-flow type, the highest economy could be attained with quite moderate stresses. The limit is, of course, the same for impulse as for reaction turbines. The output per ton is much more at 1,500 revolutions than at 750 revolutions per minute, which is easily understood when it is remembered that the efficiency of a steam turbine largely depends on the "velocity ratio," or the ratio of blade to steam speed, which again, with given steam conditions, depends on the "coefficient" or the revolutions^2 $\times$ mean diameter^2 $\times$ number of rows of blades. For a stated number of revolutions this coefficient is obviously approximately proportional to the volume of the turbine casing. It is thus seen that the volume of the turbine casing, and therefore the weight, is only about one quarter for 1,500 revolutions per minute of that required for 750 revolutions per minute. The smaller weights to be handled at the higher speed means, moreover, a much lighter construction of the engine house, smaller cranes and less massive foundations.

There would, it appears, be no difficulty in constructing an alternator of this output to run at the speed named. Last year the Westinghouse Company were building alternators to run at this speed with an output of 20,000 kilowatts. At Marylebone the Oerlikon Company is installing a 3,000-kilowatt machine to run at 3,000 revolutions, capable of carrying an overload of 4,200 kilowatts. Since the output of an alternator varies nearly as the inverse square of the revolutions, or, by the same law as that of the turbine, it should be as easily practicable to build a unit developing 12,000 kilowatts to 14,000 kilowatts at 1,500 revolutions per minute.

In view of the ease of carriage, the light weights to be handled, and the facility with which the turbine could be dismantled when required, it would seem that the smaller high-speed plant is really much to be preferred to the larger, and since the weight per kilowatt is less, the cost should also be lower, particularly in view of the high price of very large castings and very heavy forgings, to which attention has already been called. Moreover, with the very large structure, distortions, due to its own weight and to temperature variations, are more pronounced, making it necessary to adopt clearances proportionally larger in the larger unit, so that the smaller machine might actually prove the more economical under test, though data on this point are still lacking.—*Engineering.*

Fig. 1.—Electrical Laboratory of the Dresden Technical School.

Electrical Laboratory of the Dresden Technical High School.

The Technical High School in Dresden, Germany, is one of the largest and best equipped of the German schools devoted to training in technical subjects. These schools correspond in their scope with the engineering courses in the American universities, but in that country this work is done in separate institutions from the universities, which are devoted chiefly to professional courses and courses in arts and sciences.

The Dresden school comprises a number of buildings, of which only the electrical laboratory will be described here. An outside view of this building is shown in Fig. 1. A wireless antenna reaches from the roof of this building to that of another one of the school buildings.

This building faces approximately north and covers an area of 160 by 125 feet. It comprises a basement and three stories. In the center there is a room for large machines in the basement, with a clear height to the skylight forming the roof.

Plans of the basement and of the second story are shown in Figs. 2 and 3. The basement comprises, in addition to the large testing room, rooms for the heavy machinery, storage batteries, etc. The storage batteries are mounted in two rooms designated on

the plan as 5 and 6. A view of this room is shown in Fig. 4. Room 19 is for cable testing and Room 18 is for high-tension work. Room 14 contains three motor-generator sets, and power for all purposes is taken from one of these or from the storage batteries. Two of the motor-generator sets have a capacity of 30 kilowatts, while the third is rated at 10 kilowatts. Direct current is supplied at 110 and 500 volts, and alternating current at 50 cycles is provided at 110 and 220 volts, two-phase and three-phase. Two of the motor-generator sets comprise three machines each, one motor and two generators. The third motor-generator set generates direct current at low voltage—20 to 70 volts. Its speed is variable between 650 and 1,300 revolutions per minute. These motor-generator sets are shown in Fig. 5. They are connected to switchboards by means of conduits running under the floor. On the plan, *F* designates the direct-current switchboard, which is also visible in Fig. 5; *G* indicates an alternating-current switchboard.

Room 3 in Fig. 2 is a residence for the janitor; 11, a lavatory; 13, a chemical laboratory; 15, a store room; 16, a machine shop; 17, a carpenter shop. Room 2 is a large testing room, the bed plates for machines being represented by *C* and *D*, while the channels for running conductors are designated by *E*. *B* represents a general switchboard.

It has been found that for most experiments a medium size of machine of about five horsepower is the most satisfactory. These are mounted upon bed plates made of I-beams and standing two feet above the floor. Several machines can be mounted upon one of these. Switchboards for controlling the driving motors are mounted upon the walls of the room together with instruments, circuit-breakers, etc. The rheostats are usually mounted upon the bedplates themselves. From the switchboard six circuits are carried to each one of these bedplates, The room provides facilities for operating from 18 to 24 machines at one time. Adjacent to this large room are instrument rooms for storing instruments, resistances and other apparatus. In the large testing room there is an electric crane with a capacity of 5.5 tons. It is mounted at a height of about 40 feet. It can be used not only to move machines over the floor but can be used to lift objects to the upper floors and deposit them upon balconies projecting from the corridors. Wagons can be driven in directly under this crane on the basement floor.

The first floor is used for more delicate measurements and in addition to laboratory rooms contains a room for electrical standards as well as offices for the director of the laboratory and his assistants.

On this floor there are two photometers, one of which is planned for arc lamps. Among the photometers there is one Ulbricht sphere for determining mean spherical candlepower.

Upon the same floor are rooms especially designed for alternating-current experiments. In each one of these there is a motor-generator set of about one kilowatt capacity in order to permit operation independently of the large machines in the basement. One room is set aside for transformer work.

On the second floor there is a large lecture room, No. 45 in Fig. 3. No. 46 is a preparation room, while 47 and 48 are used as a library. No. 50 is a smaller lecture room and No. 52 is a museum. Rooms 50, 51 and 52, together with some rooms on the floor below, are used by the department of telegraphy and signal work. Nos. 42 and 56 are drafting rooms.

The top floor contains a lecture room and four class rooms, together with a photographic room and rooms for the janitors. An electric elevator with a capacity of 300 kilograms connects the different floors.

There are three storage batteries of 60 cells each in room 6, Fig. 2. Of these, one has a capacity of 24 amperes; one of 36 amperes and one of 100 amperes, based upon discharge in three hours. The cells are arranged in groups of five and connect to a switchboard in the corridor, 6a. Connections of these groups in parallel or in series can be made by means of an arrangement of alloy brushes which

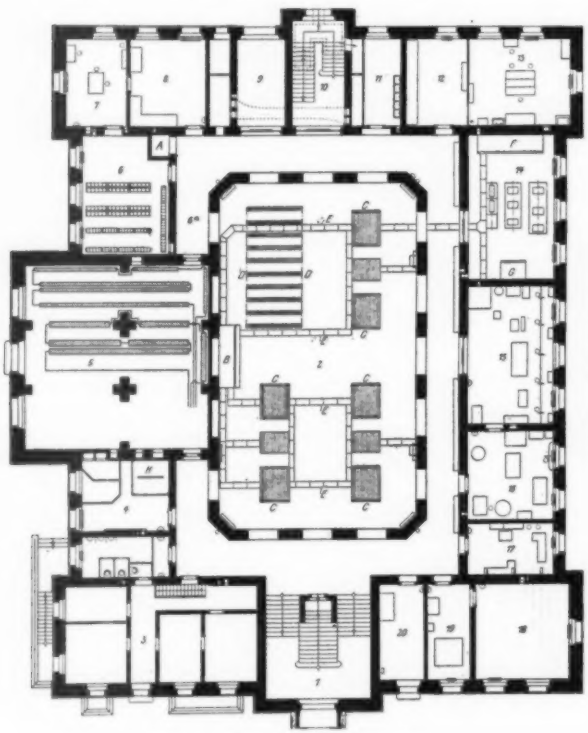


Fig. 2.—Plan of the Basement.

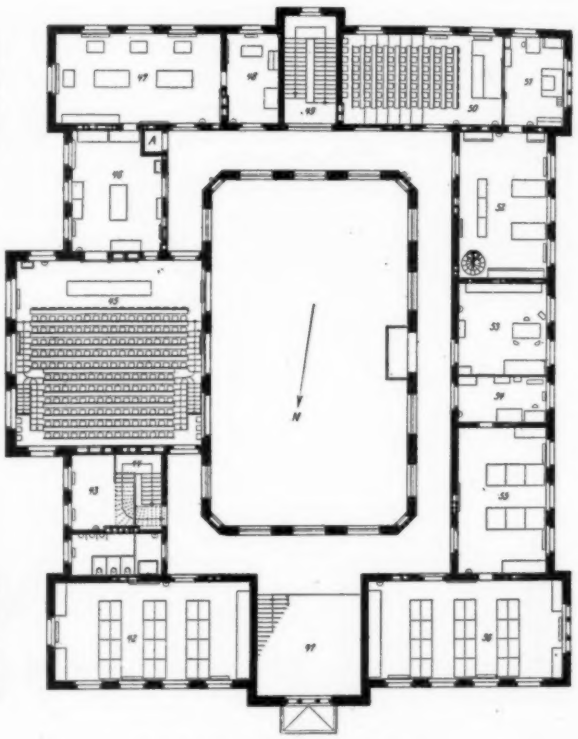


Fig. 3.—Plan of the Second Floor.

make contact with brass strips on the switchboard. By this means voltages from 10 to 120 volts can be secured.

The various sources of current are connected to the horizontal bars of the two general switchboards, of which

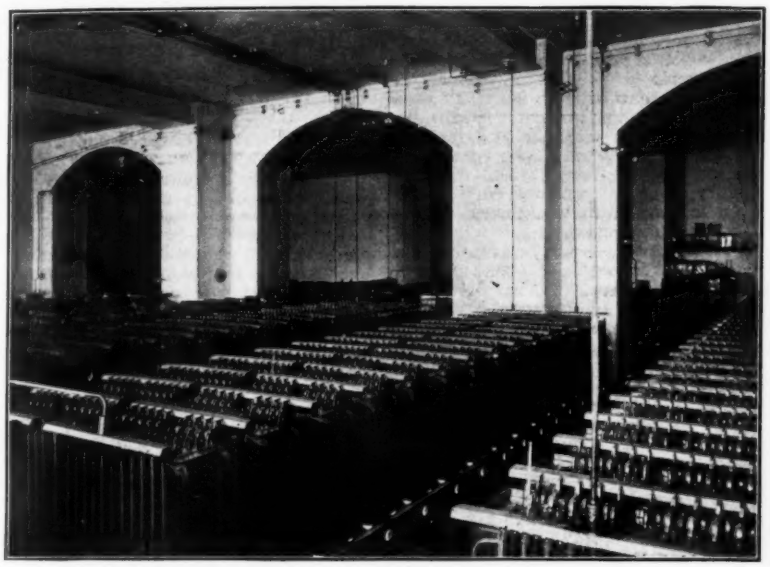


Fig. 4.—Storage-Battery Room.

one is in the large testing room in the basement and the other is on the main floor. These horizontal bars are 20 millimeters square and there are 22 of them on each switchboard. The sources of current are arranged in

Fig. 5.—Motor-Generator Sets.

order from below upwards, according to voltage, the 500-volt machine being connected at the bottom, then the 220 and 110, then the three storage batteries and finally the 20-volt generator, these being all for direct current. Above are bars for the two-phase and three-phase generator connections. Connections are made to these horizontal bars by means of conical plugs with porcelain handles which are connected to flexible cords containing copper cable. The other ends of these cords are connected to the distributing circuits. The flexible cords come out of the board through porcelain rosettes and when the plug is not in use the weight of the cord causes it to slide through the rosette until the plug rests against it. Since each distributing circuit ends in a plug it is impossible to place more than one source of current upon the same circuit, and the conical portions of the plug are so short that it is not possible to bridge over two of the horizontal bars with one of them and thus cause a short-circuit. The general distribution board in the basement is about 15 feet long and that upon the main floor about 16.5 feet. The former has 78 connections and the latter 94.

From these general distributing boards the circuits lead to the various laboratory rooms, to the lecture room and to the large machines in the machine room. In the laboratory rooms the circuits end at distributing boards which have the same arrangement of horizontal bars with plugs and cords. The experimental circuits in each room end at binding posts mounted upon small marble boards mounted upon the wall.

For laboratory work, a number of portable tables upon which switchboards have been mounted are used. The tops of these tables are about 4 by 2.3 feet and are about 30 inches above the floor. From this a vertical board rises about six feet, upon which is mounted the instruments, rheostats, switches, etc., necessary for an experiment. Upon the back of this board there are sockets for the insertion of lamps as resistances. The portability of these tables permits great freedom and flexibility in arranging the work.

The lighting of the building is provided partly by arc lamps and partly by incandescent lamps. The large machine room is lighted by eight arc lamps mounted at a height of about 23 feet. These provide an illumination upon the working plane of about two foot-candles. In the lecture rooms and the drafting rooms indirect lighting is used exclusively. Arc lamps are used in the indirect fixtures and in the experimental lecture room the intensity of illumination upon the demonstration tables is about 10 foot-candles.

Electric Club of Chicago.

At the meeting of the Electric Club, Chicago, on December 18, an address was made by Charles S. Deneen, ex-governor of the State of Illinois, whose talk dealt with some of the more important developments in the history of the state.

December 11 was Ladies Day and the program included a demonstration of tango dancing and an illustrated talk on South Africa, by Captain Foran. H. H. Cudmore, a guest at this meeting, spoke in regard to the Society for Electrical Development.

As examples of the work of the boys in the industrial department of the public night schools of Pittsburgh, Director J M. Berkey has placed on exhibition four complete electric cookers made by the boys at the Irwin Avenue school.

American Telephone & Telegraph Company Proposes Independent Control and Management of Western Union and Arranges for Extension of Long-Distance Facilities to Independent Companies.

Undoubtedly the most important st p ever taken by a large business organization to comply with the present Federal interpretation of the Sherman Law, has been taken voluntarily by the directors of the American Telephone & Telegraph Company in proposing to dispose of its holdings in the Western Union Telegraph Company; its assurance of no further acquisition directly or indirectly of control over any other telephone company, owning, controlling or operating exchanges or lines which may be operated in competition with the exchanges or lines of the Bell system, and its proposal to effect arrangements under which all other telephone companies may secure for their subscribers toll service over the lines of the Bell system.

The proposals of the American Telephone & Telegraph Company were framed by N. C. Kingsbury, vice-president of the company, and were incorporated in his letter addressed to the Attorney-General and dated December 19, in full as follows:

Wishing to put their affairs beyond fair criticism, and in compliance with your suggestions, formulated as a result of a number of interviews between us during the last sixty days, the American Telephone & Telegraph Company and the other companies in what is known as the Bell system have determined upon the following course of action:

First. The American Telephone & Telegraph Company will dispose promptly of its entire holdings of stock of the Western Union Telegraph Company in such a way that the control and management of the latter will be entirely independent of the former and of any other company in the Bell system.

Second. Neither the American Telephone & Telegraph Company nor any other company in the Bell system will hereafter acquire, directly or indirectly, through purchase of its physical property or of its securities or otherwise, dominion or control over any other telephone company owning, controlling or operating any exchange or line which is or may be operated in competition with any exchange or line included in the Bell system, or which constitutes or may constitute a link, or portion of any system so operated, or which may be so operated in competition with any exchange or line included in the Bell system.

Provided, however, that where control of the properties or securities of any other telephone company heretofore has been acquired and is now held by or in the interest of any company in the Bell system and no physical union or consolidation has been effected, or where binding obligations for the acquisition of the properties or securities of any other telephone company heretofore have been entered into by or in the interest of any company in the Bell system and no physical union or consolidation has been effected, the question as to the course to be pursued in such cases will be submitted to your department and to the Interstate Commerce Commission for such advice and directions, if any, as either may think proper to give, due regard being had to public convenience and to the rulings of the local tribunals.

Third. Arrangements will be made promptly under which all other telephone companies may secure for their subscribers toll service over the lines of the Bell systems in the way and under the conditions following:

1. Where an independent company desires connection with the toll lines of the Bell system, it may secure such connection by supplying standard trunk lines between its exchange and the toll board of the nearest exchange of the Bell operating company.

2. When the physical connection has been made by means of standard trunk lines the employees of the Bell system will make the toll-line connections desired, but in order to render efficient service it will be necessary that the entire toll circuit involved in establishing the connection shall be operated by and under the control of the employees of the Bell system.

3. Under the conditions outlined above any subscriber of any independent company will be given connection with any subscriber of any company in the Bell system, or with any subscriber of any independent company with which the Bell system is connected, who is served by an exchange which is more than 50 miles distant from the exchange in which the call originates.

4. The subscribers of the independent company having toll connections described above shall pay for such connections the regular toll charge of the Bell Company and in addition thereto, except as hereinafter provided, a connection charge of 10 cents for such message which originates on its lines and is carried in whole or in part over the lines of the Bell system. The charges incident to such service shall be made by the Bell company against the independent company whose subscriber makes the call and such charges shall be accepted by the independent company as legal and just claims.

5. Under this arrangement the lines of the Bell system shall be used for the entire distance between the two exchanges thus connected, provided the Bell system has lines connecting the two exchanges. Where the Bell system has no such lines arrangements can be made for connecting the lines of the Bell system with the lines of some independent company, in order to make up the circuit but such connections will not be made where the Bell system has a through circuit between the two exchanges.

6. Any business of the kind commonly known and described as long-lines business offered for transmission over the lines of the American Telephone & Telegraph Company shall be accepted for any distance, that is, on such long lines business calls shall be accepted where the point of destination is less than 50 miles from the exchanges where the call originates as well as where the point of destination is greater than 50 miles therefrom.

7. Any business of the kind commonly known and described as long lines business offered for transmission over the lines of the American Telephone & Telegraph Company shall be accepted at the regular toll rate and no connecting charge shall be required. But such calls shall be handled under the same operating rules and conditions as apply to calls over the local toll lines.

The announcement of these proposals upon the part of the American Telephone & Telegraph Company has been received with very evident satisfaction by the Department of Justice, and has created considerable enthusiasm in business quarters generally. Acknowledging Mr. Kingsbury's letter, Attorney-General McReynolds wrote as follows:

Permit me to acknowledge with expressions of appreciation your letter of December 19, outlining the course of action which the telephone companies composing the Bell system obligate themselves to follow in the future.

Your frank negotiations in respect of these matters compel the belief that what you propose will be carried out in good faith and it seems to me clear that such action on your part will establish conditions under which there will be full opportunity throughout the country for competition in the transmission of intelligence by wire.

May I take this occasion to say that the administration earnestly desires to cooperate with and promote all business conducted in harmony with law; and that, without abating the insistence that the statute must be obeyed, it will always welcome opportunity to aid in bringing about whatever adjustments are necessary for the re-establishment of lawful conditions without litigation.

President Wilson's appreciation of the great step in advance made by President Theodore N. Vail, acting for the American Telephone & Telegraph Company, and his realization of the importance of this step in assuring business generally that there need be little fear of ultimate contest or dissatisfaction upon the part of the Government and business, is plainly indicated in the letter which he sent to the Attorney-General in commenting upon the situation. This letter is as follows:

Thank you for letting me see the letter from the American Telephone & Telegraph Company. It is very gratifying that the company should thus volunteer to adjust its business to the conditions of competition.

I gain the impression more and more from week to week that the business men of the country are sincerely desirous of conforming to the law and it is very gratifying indeed to have occasion, as in this instance, to deal with them in complete frankness and to be able to show them that all that we desire is an opportunity to co-operate with them.

So long as we are dealt with in this spirit we can help to build up the business of the country upon sound and permanent lines.

The proposal of the American Telephone & Telegraph Company, coming so closely after the recent suggestions with respect to the purchasing of the telephone and telegraph lines by the Federal Government, has raised the question in a good many quarters as to whether the matter of federal ownership would now be pressed. It is understood that Mr. McReynolds believes that the agreement with the American Telephone & Telegraph Company is a long step toward a

return to competition in the telephone and telegraph field. There is no doubt but that the Attorney-General is gratified as are the independent telephone companies of the United States with the agreement. The Attorney-General is quoted in the Chicago *Tribune* of Sunday, December 21, as indicating that the Department could hardly have expected any court to order the Bell company to allow independents to make use of Bell equipment and service, as has been voluntarily proposed by the American Telephone & Telegraph Company, and there is practically no chance that the independent companies could raise sufficient funds if they had the desire to build competing long-distance lines.

The decision of the Supreme Court of California, coming 24 hours after the voluntary agreement of the American Telephone & Telegraph Company had been announced, presented a peculiar commentary on this situation. In the face of the voluntary agreement for long-distance connection upon the part of the American Telephone & Telegraph Company, the Supreme Court handed down a decision stating that an order of the State Railroad Commission compelling the Pacific Telephone & Telegraph Company to make such connections was a violation of the constitution of the United States, inasmuch as it was confiscatory.

In connection with the agitation for federal control of telephone and telegraph lines, the sentiment of the press of the country generally is opposed to the idea. However, in the House of Representatives on December 22, Mr. Lewis, of Maryland, in an exhaustive analysis of his proposal, pressed the idea of Government ownership of the telephone lines. Mr. Lewis suggests that the telegraph lines be left alone, acquiring only the telephone network and gradually building up and controlling the telegraph business of the country as a dual system.

In commenting on the purchase of the telephone and telegraph lines by the Government, Theodore N. Vail, president of the American Telephone & Telegraph Company, when asked what he cared to say in the matter, made the following statement:

I hardly think it is necessary to discuss it. If the Government wants to take over the telephone and telegraph lines of course it will do it. It's a long step, however, between appraisement of the properties and taking them over. That will require a great deal of discussion and consideration and a great appopriation.

The properties are worth a great deal more than the securities issued against them. The book value of all the properties of the Bell company and its associated companies is $160,000,000 greater than all the outstanding securities, and the appraised value of the properties is from 10 to 50 per cent greater than the book value. Every public appraisement of any of our properties has shown that the actual value of the property is 10 to 50 per cent more than the book value.

But this Government ownership is only rumor. Postmaster-General Burleson may have recommended it, but until the question really becomes an administration measure there is no necessity of discussing the matter fully or seriously. You know that other Postmasters-General have advocated Government ownership. Mr. Hitchcock did, and you know that public officials sometimes have ambitions.

No, I am not in favor of Government ownership. My experience has been that it is not as satisfactory as private ownership. Public ownership in other countries has not been satisfactory. It's poor in France. I know what it is in Germany and you have heard what it is like in England. It's not the kind of service you get in this country.

In this country you would no more think of transacting business without the telephone than without speech almost. The telephone in this country is a necessity for business. In other countries it is a convenience, not a necessity. Why, there are more telephones in New York City than in all the United Kingdom, and our company has more telephones than all the rest of the world put together.

The price of the stock has been dropping largely because the people in New England have been scared by the railroad troubles there. If the Government is going to buy the telephone and telegraph properties the stock ought to be going up instead of down. It would be impossible for the Government to buy part of our system. That would not be practical. It would be like buying one side of a pair of boots and not the other.

Referring to the relations of the American Telephone & Telegraph Company and the Western Union Telegraph Company, Mr. Vail said:

"No such thing as dissolution has occurred, for the reason that no such thing as a merger ever occurred in the past. The relations between the American Telephone & Telegraph Company and the Western Union have never been in the nature of a merger. The development of the mutual relations has been of a complementary character, or an extension by each of the other's facilities.

"Care always has been taken that nothing be done which would affect whatever competition might be considered to exist. The two services are in fact not competitive; if there is in theory any competition, it is because in some instances the uses of one service may be an alternative for the use of the other.

"If a real merger were made, and time given to complete the merger, some economies and additional new service of advantage to the public might be introduced. Whatever has been done already, it is believed, will be allowed to stand, and it is probable that some additional co-operative work may yet be accomplished.

"There is no setback in this separation to the material interests of either company, but on the contrary, now that there is some understanding of what can be done and what cannot be done, greater progress along the lines defined can be expected.

"The Attorney-General has been very considerate of the material interests of the companies, so far as consistent with his public duty, and this attitude was clearly reflected by the President. We think the problem has been worked out to the best interests of the public and of the companies."

Mr. Kingsbury added that no plan for the disposal of the company's holdings in the Western Union had yet been considered. Whatever was done would be in absolute good faith. There would be a complete separation of control. There was no intention of throwing the stock on the market, and every precaution would be taken not to do injury to the Western Union stockholders in disposing of the holdings of the American Telephone & Telegraph Company.

With the exception of Mr. Vail, who is president of both the American Telephone & Telegraph Company and the Western Union Telegraph Company, there are no other officials who are officers of both companies. Newcomb Carlton is vice-president, W. H. Baker, secretary, and A. R. Brewer, treasurer of the Western Union Telegraph Company, with offices at 195 Broadway, New York City.

Clarence H. Mackay, president of the Mackay Companies, in discussing the report of Postmaster-General Burleson suggesting the Government ownership of telephone and telegraph lines, said, according to the New York *Sun* of December 19, that the Postmaster-General was mistaken in his idea that the telephone companies are subject to the Post Roads Act of Congress of 1866. The Supreme Court of the United States in the Richmond case (174 U. S. 761) held that they are not. Mr. Mackay also said that in denominating the telegraph business as monopolistic in its nature that the Postmaster-General was mistaken, adding that if there ever has been more continuous, keen and even bitter competition than that between the Postal and Western Union he would be pleased to know when and where. Mr. Mackay considers that the money question is the most important; that $900,000,000 would not commence to figure. The Bell companies alone would demand more than that, and there are thousands of independent telephone companies and farmers' lines scattered all over the country. He is of the opinion that the entire deal, including telegraph lines, would be about $2,000,000,000. Incidentally, judging from English experience this vast sum would be entirely lost because under Government management the operating expenses year by year would exceed the income. From figures taken from a report of the Postmaster-General of Great Britain Mr. Mackay shows that the annual loss, including interest and fresh money expended, has been as follows:

Loss In Operation of British Telegraphs.

	Receipts	Actual operating expenses	Operating loss	Total annual loss including interest paid and fresh money expended
1908	$15,516,805	$17,542,840	$2,026,035	$4,847,425
1909	15,492,245	18,394,005	2,901,760	5,248,245
1910	15,830,960	17,841,015	2,010,055	5,081,835
1911	15,829,960	18,659,710	2,829,750	*5,911,605
1912	15,747,420	18,985,090	3,237,670	*5,636,965

*Estimated.

Street Lighting.

At a joint meeting of the Pittsburgh Sections, American Institute of Electrical Engineers and Illuminating Engineering Society, December 12, three papers were presented by local central-station men. As a preliminary to the scheduled papers for the evening, W. A. Darrah discussed, with the aid of lantern slides, some of the fundamental principles of street illumination.

J. F. Martin, discussing "Variables in Street Lighting," said that to the average non-technical person the quality of street lighting is dependent largely upon local conditions. And since these conditions are variable, their physiological effect must be considered in attempting to secure uniform street lighting. Some of the variables are the source of light; its color; its height and support; and local conditions of light obstructions and reflection.

City streets may be divided into two classes: (1) down-town streets, in which the traffic is congested, where there are closely abutting structures, and where there are no trees or other obstructions—for this service arc lamps or other large light sources are recommended; (2) suburban streets, in which the traffic is light, the buildings are well back from the streets and there are many trees—for this service tungsten lamps are recommended, as the more frequent spacing and the horizontal distribution allow hanging beneath the trees.

Reflection from surrounding bodies has much to do with practical street lighting. A unit near a light-colored building may produce twice as good street illumination as the same unit in the open, or surrounded by trees. The reflection from the glistening under surface of the leaves has an appreciable effect, and painting the pole white will increase the illumination ten per cent.

Variations in the quality of the light given off from the unit are produced by fouling of the glassware. Samples were exhibited, showing permanent fouling of globes from inclosed carbon arcs and from inclosed flame-carbon arcs. The light from an inclosed carbon arc is decreased about 30 per cent during a term of 80 hours; while in certain types of inclosed flame-carbon arcs the depreciation is as high as 60 per cent between trims, necessitating more frequent cleaning than trimming, at an added expense of $2.50 to $3.00 per lamp per year. The light distribution is also considerably altered by the fouling of the globes.

The color of the light has a pronounced physiological effect, and there is a growing tendency to favor lights of a reddish or yellow tinge, rather than the more blueish or greenish colors, due to the pleasing sensation of warmth produced, as well as their superior penetration through fog, smoke or haze.

T. F. Campbell presented an outline of central-station policy regarding free lamp renewals. Good lighting involves good conditions on the customer's premises, most of which are beyond the control of the central stations. Most complaints of poor light arise either from low voltage, which is strictly the province of the central station; dark walls and ceilings, and improper and inefficient shades and reflectors, over which the central station has no control; and poor lamps, which can be remedied on the part of the central station only when they assume charge of the renewals.

The useful life of a carbon or metallized-filament lamp is supposed to end with 20 per cent depreciation in light production. The actual life before breakage averages much greater, the depreciation frequently reaching 60 per cent. Most customers will not renew their own lamps, but will use gas rather than poor electric lights. This condition is obviated by free renewals. Also when the central station controls the situation it can be sure that only lamps of the correct rated voltage will be used. The free renewal of lamps also has an educational value, by which the use of electric lights is promoted. The Duquesne Light Company, of Pittsburgh, renews almost 500,000 lamps per year, supplying only metallized-filament lamps.

Depreciation of tungsten lamps is much slower, and hence useful life is usually limited by breakage. Free renewal is not therefore necessary to prevent poor lights, and on account of the cost of the lamps, and the decreased current consumption, free renewals are not customary. Many central stations supply tungsten lamps at cost, others allow the price of the carbon lamps on tungsten renewals, while others supply free tungsten renewals on sizes above 60 or 100 watts.

In a paper on "A Problem in Boulevard Lighting," J. M. Froelich described the installation of the first tungsten system of boulevard lighting in Pittsburgh, that on Baum Boulevard. The company was limited by the terms of the contract with the city to a series system, and as cheap an underground construction as possible. Because of the lack of grass plots, and the numerous street crossings, a two-inch wrought-iron conduit system was installed, and No. 6 rubber-covered, high-tension, Code wire was pulled in from post to post. The posts consist of five-lamp clusters at street crossings and on the two concrete bridges traversed, and one-lamp units between crossings. A cast-iron base and capital is used with a pressed-steel column, except on the bridges, where a complete cast-iron post is used.

On account of the small clearances in these ornamental units, a regular street series circuit was deemed inadvisable, and low-tension series circuits are used, fed from the low-tension secondaries of constant-potential transformers. To provide for outages, each lamp is shunted by a reactance, of special design, such that when the number of outages is less than 30 per cent, the current does not vary more than one per cent, while for a greater number of outages, the current drops below normal. The reactance coils are mounted just beneath the socket on the one-lamp posts, and in the base of the post of the others. The transformers have a number of secondary taps to provide for from 20 to 45 of the 6.6-ampere series tungsten lamps in the circuits, the secondary voltage range being from 270 to 550 volts.

The control of these circuits is by means of a special oil switch in the transformer primary, actuated by a solenoid which is in series with a regular direct-current, series magnetite-arc circuit, the whole mechanism being immersed under oil. The core of the solenoid is of hard steel, which becomes permanently magnetized, and serves to hold the switch closed, even if the magnetite circuit is accidentally interrupted. To open the switch in the morning, one-half ampere of alternating current is circulated through the wires of the magnetite circuit.

The power-factor of these circuits is very good, as the increased current due to the reactance coils does not exceed five per cent, and when all the lamps are burning the power-factor is about 96 per cent. This value, of course, decreases as more and more of the lamps go out, but within the limit of 30 per cent of outages, the power-factor is quite good. As high as 30 per cent of outages is possible only under extremely unusual circumstances. The efficiency and regulation of these circuits are both better than would be secured from a constant-current-regulation system, and the installation cost is much less.

The only objection to this system is that two separate grounds on the same circuit will cut out a number of lamps and their reactance coils, causing an increase of current through the remaining lamps. This is an extremely improbable possibility, but it can be guarded against by fusing the circuits very closely. This is perfectly feasible on account of the unvarying steadiness of the load.

In the discussion, which was participated in by Messrs. Muller, Swoboda, Van Sickle, Hower, Mundo, Reed, Turpin, Chillas, Bright, Darrah, Doane, Cotton, Campbell, Martin, Madison, Froelich and Keating, the following points were brought out.

The series system is cheaper to maintain and the lamps are more rugged than with a parallel tungsten system, although in Europe, probably due to different labor conditions, the parallel system is in use.

The present installation on Baum Boulevard is in the nature of an experiment. There is every reason to consider it a success, but something different may be tried in another place for comparison. It may be desirable to adapt the light unit to the particular surroundings, but in practice this is impossible, and for economic reasons all of a certain territory must be lighted by one type of unit. It is commercially impossible to throw away all existing units every time an improved form is brought out, and the only thing left is to make a "horse-sense" adaptation of the units available.

A form of flame-arc carbon was described by use of which the permanent etching of the globes is very materially reduced.

The uniformity of tungsten lighting gives trouble to automobile drivers in locating street corners. It was suggested that a red band be placed around one of the globes at the intersections, with the name of the street in cut-out letters. A paint has been devised which is red by both reflected and transmitted light, so as to be equally serviceable by day or night. Objection was made to this, as red is the universal symbol for fire-alarm stations.

A brief description was given of the tungsten post lighting of Orange Grove Avenue, Pasadena, Cal., which is one of the most expensive installations in existence. Bronze posts, costing $90 per post, support 100-watt tungsten lamps. The total cost of 170 posts was $30,000, or $176 per post, plus 32 cents per foot for conduit, of which there is over 8,000 feet.

In the Pittsburgh district, it was stated, steel does not last well at all, underground, though wrought iron might be better. The question was raised whether a fiber duct would not have been better on Baum Boulevard. The use of armored cable was also suggested as an improvement. In answer it was stated that both these constructions had been considered. Fiber duct must be laid in concrete, which makes it more costly than wrought-iron pipe, sample of which had been taken up in good condition after 20 years of service. By city ordinance, armored cable cannot be laid across streets without being inclosed in pipe; even neglecting this feature, the armored cable is more expensive than the present system, and repairs in case of burn-out would be very much more expensive. Lead-covered cable in pipe or duct would be considered an improvement over the present system, but is so much more expensive, that for the same cost it would be possible to renew the present cable six times. The cost of the present underground system, installed, including the cost of the concrete pole bases, and the labor of setting the poles, was about 34 cents per running foot.

Announcement was made that the annual banquet of the Pittsburgh Section of the American Institute of Electrical Engineers has been scheduled for Saturday evening, February 14, 1914.

The next meeting of the Pittsburgh Section, Illuminating Engineering Society, will be on January 16, 1914. Two papers will be presented:

"A Photometric Analysis of Diffusing Units with Varying Indirect Compoment," by E. B. Rowe and H. H. Magdsick.

"The Relation of the Engineer to the Problem of Fixture Design," by A. B. Wilson and F. J. Blaschke.

Further Advances in Wireless Communication With Moving Trains.

In an editorial in our issue of December 13 brief reference was made to a series of demonstration tests now being made on the Lackawanna Railroad near Scranton, Pa., on wireless telegraph communication with rapidly moving trains. Further particulars have just reached us in a newspaper dispatch.

Since the first wireless telegraph message from a moving train to a fixed station was flashed from the fast Lackawanna Limited to Scranton, several weeks ago, the improvement of the wireless service between trains and stations for commercial and operating purposes has been steadily going on. L. B. Foley, the Lackawanna's superintendent of telegraph, who has been in charge of the tests, is making sati factory experiments in fields hardly thought of when the new use of wireless was first conceived.

The latest accomplishment is the setting of signals by wireless from a moving train or from a fixed wireless station. Mr. Foley said that there was no longer any doubt that the wireless could be depended on for this signal service. If an operator at a station wants to set a signal for a moving train not in communication with him he can cause the semaphore blade of the signal post to rise or fall as he wishes by simply sounding the proper dots and dashes on his key.

"Signals can be set by wireless," said Mr. Foley, "as easily and as surely as they are now set by electricity conducted in wires. We have a selective device by which an operator can set a signal at any point if he has occasion to flag a train.

"This means that if any mistakes are made in the orders issued to engineers and conductors at stations or in the case of any emergency in which a train must be stopped to avert an accident the station operator can signal the train as certainly as if he had direct wire communication with some one on board.

"Another valuable use to which the wireless-controlled signals can be put," said Mr. Foley, "is the handling of freight trains on long runs. At present a through freight must make many stops between its starting point and destination, so that orders and instructions concerning right of way can be delivered to the conductors, but these frequent stops are a source of expense and delay which will be abolished by the wireless telegraph.

"Keeping freight trains in motion for long distances without stops will result in great economy of operation," said Mr. Foley. "Railroad operating officials know how expensive it is to start and stop heavy freight trains, the additional cost of fuel with the attendant pulling out of drawheads and the wear and tear of equipment being no inconsiderable items in themselves. With direct communication with a train and the ability to set and release signals by wireless, dispatchers can keep in touch with conductors and make the stops needless. The wireless permits the dispatcher to board every train and deliver his instructions as surely as if he handed them to the conductor in a sealed envelope.

"That the wireless service for ordinary operating purposes is no longer an experiment is proved by the fact that the Lackawanna has already depended upon it when wire communication was cut off. Recently, when a severe sleet storm put all telephone and telegraph lines out of commission in the Mountain Division of the Lackawanna Railroad, all train orders were handled by wireless between Scranton and Binghamton, where the railroad's two fixed stations are. The signals were strong and distinct, and the messages were received and sent by the operators without difficulty. The wireless was the only means of communication between Scranton and Binghamton for two hours during which 54 orders were transmitted."

As soon as all trains are equipped with the wireless the total loss of communication between trains and stations will be a thing of the past, Mr. Foley believes. Such disasters as the Dayton flood and San Francisco earthquake will no longer cause communication between storm centers and the outside world to be cut off. Messages can be flashed from fixed stations or stalled trains to the nearest station outside the trouble zone. Also derailed or wrecked trains can notify stations of accidents the moment they occur.

"Communication by wireless telegraph to and from fixed stations with moving trains is no longer an uncertainty," Mr. Foley added.

"Railroads can now go ahead and install the service without any fear of failure. There are many fields for the wireless telegraph in railroad operation, in routine business, and emergencies when lives and property can be saved by it.

"And the service can be put into operation without increasing the train crews. Regular trainmen can easily learn the telegraph alphabet or telegraph operators on trains can perform the duties of trainmen. Later, it may be found necessary and profitable to place a telegraph operator on limited trains running long distances without stopping to handle commercial telegrams for the public. Telegraph offices on trains in the future may be of as much value to the public as branch offices in hotels and other places where people congregate in large numbers."

Commercial telegrams have already been sent from the "Lackawanna Limited" and a set of regular toll rates is now being prepared by the railroad and telegraph companies.

The Faraday Society.

The annual general meeting of the Faraday Society was held on November 26, at the Institution of Electrical Engineers, London. The following officers and council were elected to serve for the year 1913-14:

President, Robert Hadfield.

Vice-presidents: G. T. Beilby, K. Birkeland, W. R. Bousfield, Bertram Hopkinson, A. K. Huntington, T. Martin Lowry, Alexander Siemens.

Treasurer: F. Mollwo Perkin.

Council: R. Belfield, H. Borns, W. R. Cooper, F. G. Donnan, Emil Hatschek, R. S. Hutton, Alfred W. Porter, E. H. Rayner, R. Seligman, Maurice Solomon.

At a special general meeting which was subsequently held certain alterations in the rules were agreed to by which members of cognate societies, to be determined from time to time by the council, might be elected for membership without being proposed by a member and without paying the usual entrance fee.

A paper communicated by Ernest Vanstone on "The Electrical Conductivities of Sodium Amalgams" was read in abstract by the secretary.

Continuing the physico-chemical investigation of sodium amalgams the author has determined the electrical conductivities of about 20 alloys. The composition of the alloys varied from 100 atoms per cent sodium to 54 atoms per cent.

In order to obtain a sufficiently long thread of metal for resistance measurements the alloys were drawn up into a capillary spiral one millimeter in diameter and about a meter in length when unwound; platinum terminals were sealed in the spiral at points about a meter apart.

The resistances were measured by a compensation method. Great difficulty was experienced in obtaining a continuous uniform thread.

The conductivity-concentration curve shows discontinuities at concentrations of 15 and 21 per cent mercury and a flat minimum at 35 per cent.

The paper is preliminary to a more extensive investigation.

A note communicated to the previous meeting by J. W. Richards, of Lehigh University, on "Overvoltage" led to some discussion.

In his note Professor Richards states that it is an error to regard over-voltage as if it did chemical work and was of the nature of decomposition voltage. He regards it as merely due to surface resistance caused by gas on the electrode, so that the energy absorbed appears as sensible heat. This was tested calorimetrically on a voltaic cell.

F. J. Brislee in a written communication criticized the author's experiments, which seemed to him to prove nothing with regard to the nature of overvoltage. The balance of evidence, however, favored the view that it is associated with the doing of chemical work followed by the degradation of the chemical energy to heat energy.

U. R. Evans opposed the view that over-potential was an irreversible electrodic change, involving waste of energy. It required no special explanation, being merely due to the fact that the formation of bubbles required a considerable degree of supersaturation of the kathode with hydrogen. It was a simple phenomenon, quite analogous to superheating a liquid—itself also a surface-tension effect.

A Noteworthy Lighting Exhibit.

A miniature exhibition of lighting and illumination effects shown by the Illuminating Engineering Society at the International Exposition of Safety and Sanitation in the Grand Central Palace, New York, December 11 to 20, 1913, was awarded a grand prize. In many respects this exhibit was remarkable and unique. First of all it was an excellent example of how some of the ordinarily dry-as-dust facts of science may be made both interesting and instructive to non-technical people. Many thousands of those who were fortunate enough to see the exhibit were manifestly filled with wonder and surprise. They had known of course that light, particularly artificial light, is one of their immediate necessities; but just how such a common everyday thing may in numerous ways affect their health and happiness, few had better than a vague idea. That it may be employed to prevent a large number of industrial accidents, and to promote industrial efficiency, that it may effect strange and sometimes comic distortions of statuary and other objects of interiors—these, not to mention a host of other possibilities, were probably known to fewer still. Side by side were models and pictures of good and bad lighting. Comparative conditions were clearly exposed. Use and misuse of light, with their attending good or bad results, were indicated in ways which were at once striking and impressive. So apparent were the advantages and superiority of good lighting that one might have wondered why so many examples of bad illumination could be found. The latter fact is all the more curious when it is learned that good lighting may be had in many cases at a cost not much if any greater than that paid for the bad illumination—in not a few instances it could be obtained for even less. It seemed evident that lighting may be good, bad, or otherwise, depending largely upon the care and skill with which it is planned, and how it is used.

The exhibit consisted of a series of booths and a large collection of pictures. Separate booths were devoted to the subjects of artificial daylight, glare, school lighting, show-window lighting, factory lighting, room lighting, and the direction of light.

The entire exhibit, which was installed under the direction of a special committee of the society, is to be placed in the American Museum of Safety, 29 West Thirty-ninth Street, New York City, where it may be seen free of charge by the public.

Long Acre Light & Power Company Appeal Sustained by High Court.

The Court on Appeals on December 19, upheld the action of the Public Service Commission of the First District of New York, in adopting its order of March 5 last approving the construction of a power plant by the Long Acre Electric Light & Power Company, and authorizing the issue of $4,000,000 in bonds and $2,000,000 in stock. The firms of Harvey Fisk & Sons and A. B. Leach & Company control the affairs of the Long Acre Electric Light & Power Company. The former company financed the Hudson and Manhattan terminals. The officers and directors of the Long Acre Company are divided between the two financial institutions. Philip G. Gossler, of A. B. Leach & Company, is president; Herbert L. Denny, of Harvey Fisk & Sons, is vice-president, and Ernest W. Bell, of A. B. Leach & Company, is secretary. The other directors are Pliny Fisk, Arthur B. Leach, George P. Toby and Albert A. Tilney. John C. Sheehan and Joseph H. Hoadley were active in the company's early development.

It is understood that the Long Acre Company has negotiated a contract with the Hudson & Manhattan Company for its supply of energy. Construction will be pressed with great activity.

BOOK REVIEWS.

"Harper's Beginning Electricity." By Don Cameron Shafer. New York: Harper & Brothers. Cloth, 275 pages (8x5¼ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This is one of the best boy's books in the Harper Series. Although a goodly portion of the space is taken up with static electricity, the illustrations and items treated are very well presented. The chapters on lighting and other commercial applications of electricity are above the average. A satisfactory introduction to most of the important applications of electricity, with the exception of radio communication, is given. The foreword is particularly sensible in that it warns young readers from tampering with power circuits.

PHILIP E. EDELMAN.

"Harper's Wireless Book." By A. Hyatt Verrill. New York: Harper & Brothers. Cloth, 185 pages (8x5¼ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This attractively gotten up book is another of the Harper Series for boys. The contents, however, are apt to be a disappointment to the young fellow who wants to know just exactly how to do everything and who wants something more than the Sunday-supplement type of information. Mr. Verrill writes much better upon other subjects. The material is of a mixed variety and not very well arranged. Several indirect items appear to have been inserted to stretch out the direct material to the size of a book. Some of the illustrations, while interesting, are not linked up with the text and serve merely as decorations. The lack of worked out designs with dimensions which will give good working apparatus together with explanations of the essentials of operation are evident, while, on the other hand, narrations by operators and general information take up the bulk of the space. Although the information given is not sufficient to enable an average reader to obtain an amateur's license, the book will be interesting and instructive to young readers.

PHILIP E. EDELMAN.

"Wireless Telegraphy and Telephony Without Wires." By Charles R. Gibson. Philadelphia: J. B. Lippincott Company. 156 pages (5x8 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This is just the sort of a little book which some may like to slip into their pockets to read while on the cars. Thanks to the author's personality, a sketchy, racy history of radio communication is presented in an interesting style. One will find, however, practically nothing that is not already fully treated in standard volumes on this subject. It is not a working manual and although it purports to be a popular account for uninitiated readers, it is not altogether a success from the viewpoint of a layman. The meaning is at times obscure and the text suffers for a lack of sufficient keyed illustrations. Thus Chapter XII, which from its title of "Other Systems" promises to be the most interesting, has no illustrations at all and the descriptions of several of the recent systems amount to little more than a statement of their names. Although the illustrations given are almost exclusively of Marconi apparatus, the author has been fair to give some of our American workers credit, something which can not be said for all British writers.

PHILIP E. EDELMAN.

"Synchronous Motors and Converters." By Andre E. Blondel. Translated by C. O. Mailloux, with additional chapters by Comfort A. Adams. New York: McGraw-Hill Book Company. Cloth, 295 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

This book is subdivided in three main parts, dealing with synchronous motors, generators and converters. The first part discussess by means of vector diagrams the working conditions of synchronous motors and generators. The vector diagrams used are of the bipolar type, which many years ago had been originated by Professor Blondel. The special feature in these diagrams consists in the use of two reference axes, one for the voltages and one for the current. By aid of these diagrams the maximum output, "V" curve, and many other characteristic features of synchronous motors can be determined.

The theory of power-factor correction with synchronous motors is fully discussed and a detailed investigation is given on the influence of a synchronous motor on the original investment and operating expenses. In the next chapter it is shown that it is not strictly correct to assume a constant self-induction coefficient for synchronous machines. It is shown that the total self-induction can be considered as the result of two components, one of which is called the "direct reaction," and the other the "transverse reaction." Vector diagrams are then given explaning the application of these two "reactions" for determining the exact working characteristics of synchronous machines. The difficult question of starting synchronous motors is very fully discussed. The last chapter in Part I is written by Professor Adams and deals with the application of the bipolar vector diagram to the so-called ampere-turn theory.

Part II treats of synchronous converters. It is shown that the vector diagram for synchronous motors can be applied to converters if the transverse reaction is omitted. A detailed discussion is given about direct-current voltage regulation by use of choke coils. Part II closes with a chapter written by Professor Adams explaining the theory of split-pole converters.

Part III determines the different coefficients necessary for obtaining numerical results with the vector diagrams and theories explained in Chapters I and II. This part of the book is especially valuable for the complete theory given on regulation and armature reaction of generators. It contains very valuable information regarding the testing of alternators in accordance with the theory of two reactions.

It is impossible to mention here all the interesting and important points discussed in this excellent book, which is so full of very valuable information. It can be highly recommended to designing engineers and for use in universities. It is the most complete treatise on this subject ever written in the English language.

H. WEICHSEL.

"Methods of Measuring Electrical Resistance." By Edwin F. Northrup. New York: McGraw-Hill Book Company. Cloth, 389 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $4.00.

This is the most comprehensive work upon the measurement of electrical resistance which is known to the reviewer. Its author has had a wide experience not only in the use of apparatus for this purpose, but also in its design and manufacture, and the results of this rich experience are given to his readers. Nearly all known methods for comparing resistances are given, but one notable omission in the methods for comparing resistances is that of Kohlrausch using the differential galvanometer and no attempt has been made to include absolute measurements. Some of the methods given are new an described in this book for the first time.

It is not claimed that the work is exhaustive, but the author has selected for presentation all methods which in his judgment are useful for commerical tests and measurements, for application in research laboratories and in instruction. Mathematics are used freely, especially in the explanation of methods and derivation of formulas.

The first chapter is of an introductory nature and takes up among other things the question of errors in measurement, the accuracy of methods, etc. The author clings to the unfortunate term "ohmic resistance." but like other users of this expression fails to inform the reader of any kind of electrical resistance which is not ohmic.

Succeeding chapters take up deflection methods, null methods, slide-wire bridges, other Wheatstone bridges, low resistances, conductivity measurements, and high resistances. Among the bridge methods that of Carey Foster receives

more consideration than it would generally be deemed worthy of. Separate chapters are devoted to the measurement of insulation, to resistance including electromotive force, to the location of faults and to the measurement of temperatures by resistance thermometers. The last two chapters take up the construction of instruments. An appendix of 20 pages contains some useful information in the form of tables and mathematical relations.

The volume is well printed and the diagrams have been made by the wax-plate process, which adds greatly to their effectiveness. Numerous examples taken from practice are given to illustrate the use of the various methods.

"The Theory of Measurements." By A De Forest Palmer. New York: McGraw-Hill Company. Cloth, 248 pages (5¾x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

This volume, written by a professor of physics in Brown University, has been prepared primarily to meet the needs of students in engineering and advanced physics in properly comprehending the limitations and value of their laboratory measurements. Endeavor has been made to develop the general theory of measurements and the errors to which they are subject in clear and concise form. It will be of little use to the practical man who is not concerned with precise measurements or the interpretation of their results. The first seven chapters deal with the general principles which underlie measurements, with the nature and distribution of errors and with the methods of combining discordant observations. The precision of measurements is then discussed and consideration given to the best magnitudes which should be chosen in indirect measurements and to the relation of the subject to research. A number of useful tables are added at the end of the volume. Particular attention is paid by the author to the proper use of significant figures and it would be well if practical men engaged in rough measurements could appreciate this feature of the discussion. The volume is primarily a textbook for students, but will be of value to all those engaged in refined laboratory work.

"The Design of Static Transformers." By H. M. Hobart. New York: D. Van Nostrand Company. Cloth, 174 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.00.

"Design of Electrical Machinery. Vol. I. Direct-current Dynamos." By William T. Ryan. New York: John Wiley & Sons. Cloth, 109 pages (5½x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.50.

These two books take up the subject of design from a standpoint which is common in textbooks on the subject and in college courses. They do not pretend to be complete treatises on the subject. Mr. Hobart states that his book is merely an introduction to practical designing and Professor Ryan recognizes that it is not feasible to develop a real designer in a college course. Nevertheless, the reviewer believes that this standpoint is a wrong one, since it results merely in teaching the students to copy machinery already extant and does not serve to familiarize him with the fundamental principles which must underlie original designing. The mathematical and physical relations which connect the proper dimensions of the different parts are duly brought out, but it is not made clear to the student how he could start out if there were not machines already in the field to copy from. For instance, if the price of steel were to be cut in half, while the price of copper remains stationary or increased, how would the design of the machine be affected? What student of such books as these, or what graduate of a college course could properly answer such a question? A prominent consulting engineer has recently pointed out a similar lack in the training of bridge engineers in college. He instances a case of the engineering corps of a railroad, which was perfectly capable of designing bridges of a regulation type—was unable to recognize a case in which an entirely different type was desirable. It was soon evident to him that "while engineering schools were turning out men who could calculate stresses and detailed structures with exactitude there was need for a wider knowledge of the primary essentials. One of the most important duties of a bridge engineer is the selection of economic types and determination of general dimensions and design, but too often this is fixed by custom, guess or judgment. The cost of a bridge is affected most of all by its form and proportions, and sizes which are too large and excessive are often specified when smaller ones with embankments on the ends would leave ample space for the highest floods." Where the difference in cost between two types of bridge might amount to $15,000 or $20,000, the greatest saving which an expert detailer could make would probably not exceed $5,000. A similar tendency to dwell upon details rather than fundamentals is evident in the instruction and the textbooks provided for students in electrical design. In the designing room of a manufacturer more detail knowledge of this type would be gained in a few weeks than in an entire college course. As such textbooks go the two under consideration are good, though necessarily limited in scope. Professor Ryan points out that the electrical designer must also be a mechanical designer, but in such a limited volume he cannot go into the details of how shop processes will affect the design of the machines in hand. His book discusses in the first chapter the relations entering into the design of direct-current, constant-potential dynamos. The second chapter is given up to illustrations, while the third works out the dimensions in a specific case. Mr. Hobart begins by pointing out the customary relation between the leading dimensions of the usual types of transformers. He then considers core loss, exciting current, power-factor and efficiency, and then takes up the details of the design of the windings and insulation. Separate chapters are devoted to the influence of frequency, regulation, heating, tanks and forced cooling.

"An Expensive Experiment." By Reginald Pelham Bolton. New York: The Baker & Taylor Company. Cloth, 281 pages (5x8 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.25.

This volume is a study of the management and operation by the Hydro-Electric Power Commission, of Ontario, of the electric service in that province. It was prompted by the movement in the State of New York looking to a similar governmental development of water power in that state and the investigation by a commission of its feasibility. Mr. Bolton has made a careful study of the facts connected with the Ontario Commission and has concluded that it is not a financial success; that proper provision is not being made for depreciation; that if such provision were made the expenses of operation would be greater than the receipts; that consequently the activities of the Commission represent a charge against the people of the province which must ultimately be made up out of taxes; that the smaller municipalities have been discriminated against in favor of the larger ones; that the true facts connected with the Commission's activities have been kept secret and a campaign of misrepresentation carried out in the public press. He has collected a convincing assembly of facts to demonstrate these conclusions. While the engineering work upon the transmission lines of the Ontario system has been of a high order, the system has not been without its interruptions and other difficulties usually encountered in the operation of such a system. The discussion refers principally to the Niagara development, but chapters are also devoted to the projects at Ottawa and at Port Arthur and to the Big Chute system. He concludes that the activities of the Hydro-Electric Power Commission have not been of advantage to the populace as a whole and that private operation of such utilities combined with government regulation is superior to government ownership and operation.

"Theory and Practice of Technical Writing." By Samuel Chandler Earle. New York: The Macmillan Company. Cloth, 301 pages (5x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.25.

Reports of engineers, like financial statements, are notoriously obscure, and

it is generally admitted that the average engineer has not the facility in expressing his ideas in good English which is desirable. Since the principle of the conservation of energy was generally accepted, mechanical efficiency has received great attention from the engineer. Of late years the so-called efficiency engineer has brought the efficiency of the shop and of the workman in the lime-light. The efficiency of engineering education is now receiving consideration, but efficiency in the use of English has as yet hardly occupied the engineer's thought. This book is a contribution towards a better state of affairs. It is written by the professor of English in the Engineering School of Tufts College and a perusal of it should help anyone engaged in technical writing, and more especially the engineering student, to better express his ideas. English grammar and compostion, like English spelling, are to a large extent arbitrary, and the choice of words and general style must be even more so. This has led to the formulation of rules based largely upon authority and experience, but reliance upon such rules rather than upon judgment and knowledge of correct usage is dangerous. An instance of this occurred recently in the *Bulletin of the Society for the Promotion of Engineering Education,* where a writer gave a list of words and expressions to be used in preference to others. Some of the directions there given could not be justified upon a grammatical basis. Professor Earle, however, has approached his subject from a logical basis. The book is divided into three sections. The first is given over to a theoretical consideration of the principles involved. The second part points out the practical application of these principles, and the third gives a number of illustrative examples, comprising about a quarter of the entire book. The author has recognized that the engineer no less than members of other professions needs special training in writing over and above that which is obtained in customary courses in general composition.

"The Year-Book of Wireless Telegraphy and Telephony, 1913." London: The St. Catherine Press. Cloth, 563 pages (5½x8 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This volume fills a place which has been waiting for some years to be filled and it will no doubt be found valuable to those interested in wireless work, although some readers may have preferred a different choice of material for its contents. There is unquestionably, however, much information of value which has by this means been put in ready form for reference. A yearly record of progress in this field is given; and there are a list of wireless stations of the world and a map showing the same. A record is given of the International Radiotelegraph Convention and of the laws and regulations governing wireless operation in different countries. There are a glossary of wireless terms, a collection of formulas, a list of wireless patents and a collection of tables which are all useful for reference. Illustrated biographical sketches of men who have been prominent in the development of wireless work find a suitable place in this volume. A list of commercial companies is also given. A considerable part of the volume is taken up with technical articles by various authorities upon such subjects as measurements, time signals, radiotelephony, syntony, the production of continuous waves and other subjects of interest to the wireless devotee. Naturally, this volume has some shortcomings, one of which is the neglect of systems other than the Marconi. The lists of books and of periodicals which are denominated as the literature of the subject are so incomplete as to resemble rather a selling list. It is to be hoped that this publication will be continued from year to year and made more complete. This can be done without adding to the number of pages, since much of the matter which appears in the first edition will not need to be repeated in the future year-books.

"Conservation of Water.' By Walter McCulloch. New Haven: Yale University Press. Cloth, 99 pages and 40 plates (7x9¾ inches). Supplied by the Electrical Review Publishing Company for $2.00.

The contents of this volume are made up of a course of addresses delivered at Yale University in the Chester S. Lyman lecture series of 1912. The fund for these lectures was established for maintaining courses on the subject of water storage conservation. In an introductory chapter the author points out the data which are essential in a comprehensive study of water storage and then discusses not only the use of water power in developing energy for other purposes, but treats also of water storage for the supply of municipalities, for sanitation and for irrigation, which he considers the more important problem. The statistics given are made clear and forcible by the use of diagrams. Finally the water resources of New York State are considered at some length.

"American Telegraph Practice." By Donald McNicol. New York: McGraw-Hill Book Company. Cloth, 507 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $4.00.

This volume is based upon a course of lectures given by the author in the evening Technical School of Columbia University. It has been suited to the man engaged in the practical work of telegraphy who is not deeply grounded in mathematics, although some use has been made of this adjunct in developing the subject. Of the 24 chapters, six are of an introductory nature, dealing with the fundamentals of electricity and magnetism; then 14 deal with telegraphy proper, concerning more especially the terminal offices. One of these chapters deals with high-speed automatic telegraphy. Of the remaining chapters, one is devoted to disturbances from power lines; one to simultaneous telegraphy and telephony; one to specifications for wire and cables; and one to electrolysis. Outside of these little attention is given to the outdoor equipment. For the field taken up the volume is, however, a very comprehensive one; it is well printed in large type and illustrated with well drawn diagrams, as well as a number of halftones. The volume should serve as an admirable textbook for either students or operating men desiring to familiarize themselves with present-day practice in transmitting telegraphic signals.

"Electrical and Magnetic Calculations." By A. A. Atkinson. Fourth edition, revised. New York: D. Van Nostrand Company. Cloth, 310 pages (5x7 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.50.

This fourth edition differs from the preceding one through the correction of a considerable number of errors; the substitution of terms now in practice for some that were formerly used but have become obsolete; by the application of the wiring rules to tungsten lamps as well as carbon lamps; and by the use of a very convenient method of making magnetic calculations. In addition to solving a certain number of problems under each heading, there are also problems presented without solution to test the knowledge of the reader. After explaining the units of measurement, the successive chapters deal with resistance, energy, wiring, batteries, magnetism, electromotive force of machines, dynamo design, and alternating currents. The book will be found useful to those who experience trouble in applying the well known formulas to numerical calculations.

"Practical Uses of the Wave Meter in Wireless Telegraphy." By J. O. Mauborgne. New York: McGraw-Hill Book Company, Incorporated. Cloth, 74 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $1.00.

This little volume is a revision of instructions which were devised by the author for use at the Army School at Fort Leavenworth. It sticks pretty closely to the topic indicated by the title, and after an introductory chapter describes the Pierce and the several Telefunken instruments in use in the Signal Corps. The use of the wave meter in the measurement of wave length, in the measurement of damping and logarithmic decrement, in tuning at the sending station, in measuring wave-length at the receiving station, and in the measurement of capacity

and inductance, are treated in successive chapters. The book is very practical and is illustrated with curves and diagrams of connections. It will be found useful to the wireless operator who is not already familiar with the application of these instruments.

"Formulas and Tables for the Calculation of Alternating-Current Problems." By Louis Cohen. New York: McGraw-Hill Book Company, Incorporated. Cloth, 282 pages (6x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for $3.00.

The author of this volume has brought together a valuable collection of formulas and the derivation of the same, which are of use in the calculation of problems arising in the consideration of alternating currents, whether in power, telephone or other circuits. The present literature on this subject is so scattered that a compilation of this kind is of value. A number of tables whose use is required in such fields are included. These include values of hyperbolic functions and of various other constants, functions and correction terms. There are also a number of tables giving physical constants of various materials. The author is well qualified to make a compilation of this kind on account of his extensive work in this field. A number of numerical examples are worked out as illustrations.

"Socialism from the Christian Standpoint." By Father Bernard Vaughan. New York: The Macmillan Company. Cloth, 389 pages (5x7½ inches).

Six of the ten chapters comprising this volume were sermons or "conferences" delivered in Saint Patrick's Cathedral, New York City, in 1912. The other four were added to make the treatment more complete. The author is a Roman Catholic and a Jesuit, and the treatment is naturally from the Romanist standpoint. Since this standpoint is one of authority in religion, and since socialism, however despotic it may become in practice, can only be inaugurated upon a basis of fundamental democracy, the attitude of the author can only be one of intense opposition to socialism, which he finds essentially anti-Christian. A chapter is devoted to the Christian Socialist, but the author does not regard this sect as representing real socialism, the spokesmen for which he chooses from among the irreligious materialists comprising many of the recognized leaders and authorities among the socialists. The author recognizes the great evils of the present social and industrial order, and agrees that they cannot indefinitely continue; but he holds that a choice must be made between "On to Socialism" and "Back to Christianity." He makes a fair argument for individualism, but fails to answer the question which arises in the reader's mind as to how the teachings of Jesus are to be reconciled with a regime of competitive business and competitive job-seeking. To some, Christianity connotes the Mosaic law and the theology of Paul, but if one considers the self-sacrifice, self-abnegation and non-resistance of Jesus, it is seen to be incompatible with competitive self-seeking. A business man can be successful only by restricting his practice of the teachings of Jesus to one day in the week.

The author shows an extensive familiarity with the literature of socialism, as well as with modern social conditions. He condemns socialism on the three grounds that it is in conflict with the Christian ethics of justice, equity and right; its consequences would be pernicious and disastrous to the individual, to religion and to the state; it assumes that our social and industrial evils are inherent in the system of private capital. Unfortunately, he does not pursue the last subject with the same avidity as the first two, and fails to show to what social evils are due. If he did so he might be led to suggest other remedies which would convince the reader that socialism is not necessary. Thus he might have pointed out that the appropriation by the Government in the form of taxes of the entire economic rent of land sites would make opportunities for labor which would entirely solve the problems of a living wage and unemployment. He advocates, for social amelioration, legislation, private endeavor and Christian enterprise, and admits "Nor can the Christianity of Christ alone solve the social question." His ideas of legislation are along the line of compensation acts, child-labor laws, etc. Under private endeavor he warmly commends welfare work, pensions, etc.

Our concern here is chiefly with the matter of public ownership and operation of electric utilities. Upon the subject of public utilities the author is silent. He recognizes the appropriateness of interference by the State in all matters touching the well-being of the people, which cannot be handled individually. Of course, anyone who believes in Government ownership and operation of the post-office, the schools, the sewers, etc., is to that extent a socialist. We only differ in the extent to which we would go. Some would stop at water supply, and some would include all public utilities. But the dyed-in-the-wool socialist would include all industries, whether public utilities or not, so as to leave no opportunities for the use of private capital. Father Vaughan does not tell us where he would draw the line.

"The Foundations of Alternate-Current Theory." By C. V. Drysdale. London: Edwin Arnold. Cloth, 300 pages (5¼x 8⅛ inches), illustrated. Supplied by the Electrical Review Publishing Company for $2.50.

This book represents a course of study given by the author at the Northampton Institute, Reigate, England. While written for students just taking up the subject for the first time it assumes a previous understanding of mathematics, although the mathematical work is kept down to a minimum. Mechanical analogies are given to explain the theory whenever possible and it has been found possible to do this to an unusually complete extent. The well known models of Lodge and Maxwell have been a basis for this. The author's style is clear and he has covered the field very successfully, so that one who masters this volume should have a very thorough knowledge of present theories of electrical phenomena.

Annual Tables of Constants.

"Vol. III of the Annual Tables of Constants and Numerical Data, Chemical, Physical and Technological," published by the International Commission of the Seventh and Eighth International Congresses of Applied Chemistry, is now in press and will be issued early in 1914. A descriptive circular with references to reviews of previous volumes may be secured on application to The University of Chicago Press, the American distributors.

The subscription to Vol. III is now open and will be closed March 31, 1914. The names of subscribers should be sent to The University of Chicago Press, to whom subscriptions are payable at the time of publication. The subscription price will be $6 for unbound copies and $6.80 for bound copies (carriage free). Members of contributing societies (the National Academy of Science, the American Academy of Arts and Sciences, The American Chemical Society, The American Electrochemical Society, The Society of Chemical Industry) and of contributing manufacturing establishments, are entitled to a discount of 20 per cent (but not on the binding) and will receive the volume unbound for $4.80, bound for $5.60 (carriage free) provided their subscriptions are received by March 31. After that date the prices will be $6.40 (unbound) and $7.20 (bound); a charge will be made for carriage and no discounts allowed.

The commissioners for the United States are Julius Stieglitz, Henry G. Gale and Albert P. Mathews, of The University of Chicago, and Edward C. Franklin, of Leland Stanford Junior University.

Pittsburgh Jovians Dine.

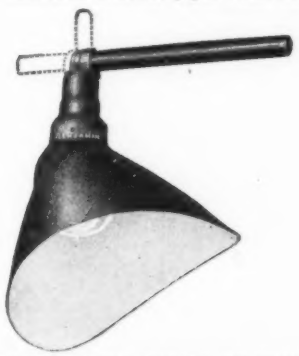
The Jovian League of Pittsburgh held its regular meeting in the Fort Pitt Hotel on December 6. Following the business meeting a banquet was held, at which Moulton Gardner delivered the chief address.

New Electrical and Mechanical Appliances

New Angle Bulletin Reflector.

A recent addition to the line of reflector sockets made by the Benjamin Electric Manufacturing Company, Chicago, Ill., is the single bulletin reflector illustrated herewith. It is made in two sizes, one having a 11.375-inch reflector and taking a 60 and 100-watt lamp for lighting up bulletin and sign boards, the other having an 18-inch reflector and using a 150 or 250-watt lamp for lighting large signs (over 12 feet high) and similar uses where a large area must be illuminated from a height at one side.

This new fixture consists of an enameled steel reflector of somewhat irregular shape to give uniform light distribution, a porcelain lamp receptacle, and a connection for securing to a half-inch bracket pipe. The reflector is also arranged for use with a gooseneck bracket pipe. The lamp is protected from loosening by the Benjamin lamp grip. Inside the reflector has an efficient and durable white reflecting surface and the outside is finished in black.



Benjamin Angle Bulletin Reflector.

Aside from sign and bulletin-board lighting, the larger of the new angle reflectors have been used successfully for lighting foundries, mills and erecting shops where the operation of traveling cranes makes the side mounting of lighting fixtures desirable. They have also found use for lighting railroad street crossings and subways, etc., where side lighting is preferable; for this purpose they will illuminate the track uniformly without throwing light directly into the eyes of the motormen or locomotive enginemen, which would increase the liability of accidents happening from confusing glare.

Moisture and Vaporproof Reflectors.

Two new types of practically hermetically sealed reflectors for tungsten lamps have been placed on the market by the Crouse-Hinds Company, Syracuse, N. Y. Of these the one shown in Fig. 1 and known as the type RM was designed particularly for use in roundhouses where it is necessary to protect the lamp socket and reflector from the combined corrosive action of steam and smoke fumes. As shown in the illustration, the reflector housing is of rugged construction, so as to make the entire outfit secure from breakage. This type of reflector is most suitable for mounting on the wall and is serviceable for a great many other installations aside from that for which it was specially designed. Thus they have been found of value in tunnels, prison corridors, large steel mills, etc.

Fig. 1.—Crouse-Hinds Vaporproof Reflector.

Fig. 2.—Vaporproof Reflector, Type R S.

In Fig. 2 is shown a reflector known as type RS. This is intended for direct connection to conduit and is best adapted for throwing light downward from the ceiling, the bell shape of the reflector being designed for this purpose. The reflector housing of this reflector is similar to that of the one just referred to, and, being made in one piece, the reflector and lamp are thoroughly protected by the heavy cast-iron case. The glass cover fits tightly against the casing, there being a gasket between the glass and iron. These type RS reflectors have been used for a variety of installations where downward illumination is needed in a place subject to a great deal of dampness or corrosive fumes.

Sunlight Mirror Reflectors.

The prevailing efficiency movement has called for improved methods in connection with all commercial and industrial establishments. One of the incidental ways in which this has manifested itself is in improved and more efficient methods of lighting which have made great headway in recent years. Improvements in lighting have been the result both of improved lamps and of better methods of utilizing their light through the liberal use of reflectors.

Fig. 1.—Sunlight Conical Reflector.

Numerous tests have shown that mirrored-glass reflectors are the most efficient and this accounts for their rapidly increasing use. To meet this increased demand the Sunlight Reflector Company, 143 Court Street, Brooklyn, N. Y., has placed on the market an extensive line of mirrored reflectors, of which three are illustrated herewith. The deep cone shade shown in Fig. 1 is made in seven sizes, ranging from 5 to 14 inches in diameter. The metal hood is finished a green color on the outside and is lined with either plain or corrugated mirrored glass or with opal glass. These reflectors are useful for a great variety of purposes.

For store-window lighting there are many cases where a strong light is de-

sired directly downward on the goods displayed. In such cases square reflectors of the type shown in Fig. 2 are coming into vogue. These are placed at the top of the window in square holes cut in the false ceiling so that the lower edge of the reflector is flush with this ceiling. When evenly placed throughout the ceiling, these reflectors throw all the light downward and distribute it uniformly over the horizontal surfaces in the window display. These square reflectors are made with either flat or corrugated mirror interior surfaces and range in size from 6 to 14 inches square.

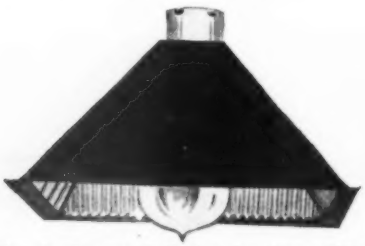


Fig. 2.—Square Reflector for Show Windows.

A similar type of window installation is sometimes desired with round instead of square reflectors. In this case a ceiling ring is used to support the round reflector, as shown in Fig. 3. The Sunlight Reflector Company makes many other kinds of show-window reflectors, also reflectors for lighting show cases, bowling alleys, picture galleries, desks and tables, signs, stage border and footlights, etc.

Cordless Jack Boxes for Way-Station Service.

A simple switching device for connecting the operator's set in a railroad way station to one or more lines passing through the station is found in the cordless jack box recently perfected by the Western Electric Company's railway engineers. The cordless jack box does away with the unsatisfactory knife-switch method of cutting in the operator's telephone or telegraph set on the train-dispatching lines. The connection is effected by means of a single-conductor plug which is inserted in the line jack corresponding to the line over which it is desired to talk or telegraph.

Fig. 3.—Ceiling Ring for Show-Window Reflectors.

The cordless jack boxes are of two kinds, one for telephone-dispatching circuits and the other for telegraph lines, a different style of jack being necessary in the latter case on account of the different nature of the telegraph circuit and apparatus. One distinctive feature of the telephone jack boxes is that they may be used to connect two or more lines together and have the operator's set bridged in on all of them, merely by using one or more extra switching plugs.

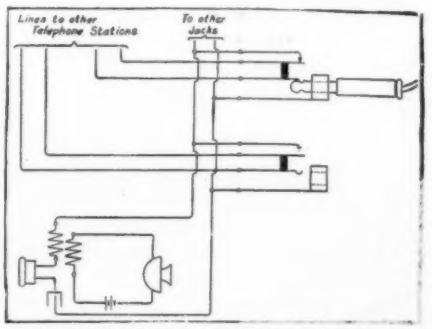
Solid oak is used in the construction of the jack boxes with a cover made of three layers to keep it from warping. This cover is hinged so that it may be opened for inspection. There are no superfluous parts to clutter up the inside of the box. The jacks are made with heavy insulation to prevent trouble from sudden voltage surges or accidental crosses with power or lighting circuits, and all jack springs are widely separated to prevent arcing and burning of installation. Screw terminals are used for connecting in outside lines. No soldering is necessary. A tie cord is furnished with the switching plug to keep the latter from being mislaid when not in use.

Cordless Jack Box for 12 Lines.

The cordless jack boxes are manufactured in three sizes: the No. 385 type for three lines, the No. 386 type for six lines and the No. 389 type for twelve lines, consisting of two six-line units hinged together. Any of the jack boxes can be ordered partially equipped with dummy wood plugs in the unequipped spaces. Jacks can be added at any time by knocking out the wood plugs and screwing in the jacks. Wiring is always furnished for the full equipment. A number of trial installations of these cordless jack boxes have already been made.

A New Test Clip for Heavy Currents.

Where a large number of test readings have to be taken of different circuits in test rooms or laboratories, test clips have been found to be of great convenience and time economy. While this has been particularly true of voltage readings, it is now also possible to make a variety of current readings by means of a new test clip being placed on the market by R. S. Mueller & Company, 423 High Avenue, Southeast, Cleveland, O. This clip, which is shown full size in the illustration herewith, is said to be capable of carrying 100 amperes continuously without heating. When applied to flat surfaces where the jaws make exceptionally good contact, it will carry even heavier currents.



Circuit Diagram for Telephone Jack Box.

The outer members are of special alloy containing about 94 per cent copper and thus have high conductivity. The blue steel spring within provides a strong means of gripping the jaws to the conductors; its point of application is near the jaws, thus giving a long leverage and therefore firm contact. Copper leaves are placed under the spring for a double purpose; they carry current picked up by the jaws to that side to which the connecting cord is attached; they also act as a shunt around the spring to protect it from heavy currents which might otherwise pass through it and affect its temper. The jaws have a spread of seven-eighths of an inch and are so completely shaped as to permit entering into close quarters. The connecting cord can be readily and securely fastened to the test clip; No. 10, 8 or 6 flexible wire or cord is recommended.

Test Clip for 100 Amperes.

Recovering Iron from Steel-Plant Waste by Electromagnetic Separation.

There is a vast amount of iron lost in the waste material of the blast furnace, converter and other equipment of the modern iron and steel plant. A unique electromagnetic iron-separating apparatus has been devised at Hagen, in Germany, by George Rietkötter and placed in operation in connection with iron and steel furnaces in several German plants.

The crushed waste material is passed over revolving drums equipped with powerful electromagnets in such a manner that the iron is separated from the non-ferric material, the former being recovered from the waste at very slight expense.

The accompanying illustration, Fig. 1, shows the electromagnetic iron-separating installation at the Rote Erde plant of the Gelsenkirchener Bergwerks Aktiengesellschaft near Aachen, Germany. There are two electromagnetic drums at this installation having a capacity of 200,000 kilograms per day of ten hours. The material is brought to the separating apparatus by a rope railway and raised by an elevator to the magnetic drums, where 95 per cent of the iron is saved from the material handled, representing that part of the waste which is very rich in iron. Of the balance of the waste, representing 79 per cent, which is a much finer material, the product contains 91.7 per cent of iron and 8.3 per cent of waste.

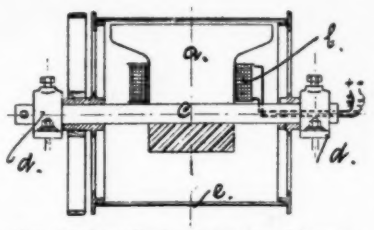


Fig. 2.—Longitudinal Section Through Drum.

The electromagnetic separating drums are operated by electric power at this plant, which has a capacity of ten tons per hour and cost complete $4,500. The cost of operation of the plant, including oil, labor, interest and electric power was only $69 per day. 7.5 horsepower is used at a cost of one cent per horsepower-hour.

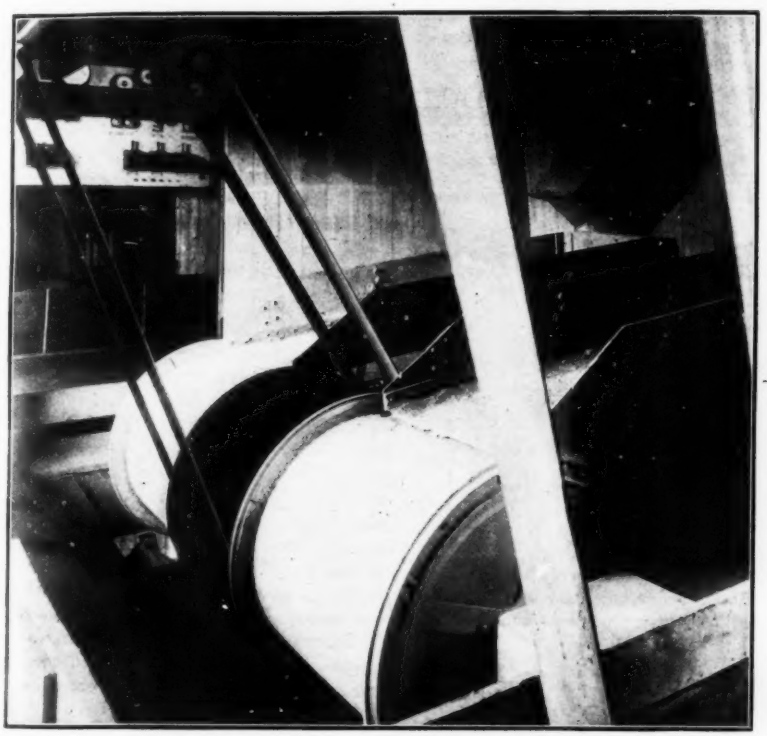


Fig. 1.—Electromagnetic Iron-Separating Plant.

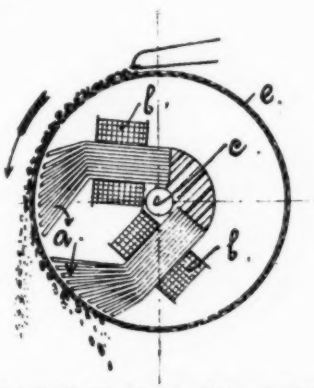


Fig. 3.—Cross Section Through Drum.

The Rietkoetter electromagnetic separator is furnished in two sizes. The smaller size has a drum 75 centimeters in diameter and 75 centimeters wide. It weighs 900 kilograms and has a capacity for separating the iron from 13 cubic meters of waste material per hour. The power necessary for operation is 0.5 horsepower. In addition to this the electromagnet consumes six amperes at 110 volts. The arrangement of the electromagnet may be seen in Figs. 2 and 3. Fig. 2 represents a longitudinal section through the drum; *c* is the shaft resting in the pedestals, *dd*. The surface of the drum is represented by *e*. Coming close to the inner surface of the drum there are a number of magnetic poles, such as *a*, the coil for exciting the electromagnet being represented by *b*. Fig. 3 shows a transverse section through this drum, from which the construction of the electromagnet will be clearer. A section through the material of the drum itself is shown in Fig. 4. This is of steel, but is broken up into sections separated by nonmagnetic material, as at *f*, so that the lines of magnetic force tend to spread out into the air and make a magnetic circuit through the particles of falling material. The general path of the lines of force is shown from one of the magnet poles at *e* through the material of the drum and across the gap at *f*. From here it would be continued to the poles of opposite polarity in the lower portion of the figure. The material to be separated is deposited upon the upper part of the

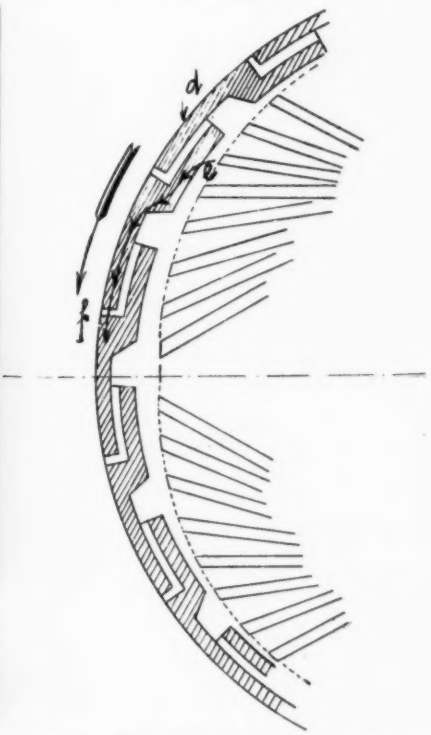


Fig. 4.—Enlarged Section Through Drum Periphery.

drum and as the latter revolves the non-magnetic materials drop vertically from the edge of the drum, whereas, the magnetic particles are held until they pass around beyond the poles of the electromagnet in the lower portion of the drum, as shown in Fig. 3.

The larger size of separator has a drum 130 centimeters long and a diameter of 75 centimeters. It has a capacity of 25 cubic meters per hour, although the power for driving is increased only to 0.7 horsepower. The electromagnet, however, requires nearly 1,400 watts and the weight of the apparatus is 1,620 kilograms.

At the Schutt Giesserei 1,300 kilograms of cupola or blast-furnace waste is handled per day with 12 per cent of iron, and 700 kilograms of converter waste with 20 per cent iron, and an equal amount having 60 per cent iron, together with 400 kilograms of other waste material which averages 20 per cent iron. The cost of the plant was $1,000 and the cost of operation is exceedingly low.

New Office Building of General Electric Company at West Lynn.

On December 12 the new general office and administration building of the General Electric Company at West Lynn, Mass., was dedicated under the auspices of the General Electric Mutual Benefit Association. This organization comprises nearly 6,000 members, or about one-half of the total number of employees at the West Lynn factories.

The entire building was thrown open to visitors, and over 3,500 people were in attendance and enjoyed a varied entertainment, consisting of a popular concert, dancing and historical stereopticon lecture. Besides Mayor George H. Newhall of Lynn and other local celebrities there was an informal reunion of old "Thomson-Houston" men. Among these may be mentioned E. Wilbur Rice and A. L. Rohrer, of Schenectady; Dr. Elihu Thomson, of Swampscott; and Charles E. Morey, of Lynn, the latter having been employed as a winder by the present company or its predecessors for 33 years continuously.

The building, which will be known as No. 45, is 254 feet long, 52 feet wide, and four stories high, with a commodious basement. The location is at the "River Works," West Lynn, on Western Avenue, which is on the direct trolley line to Boston. The design of the building is free classic, marked with strong vertical and horizontal lines. The facade towards Western Avenue, with its portico and steps, relieves the flatness of the wall surface. The outside walls are sand struck, with granite and limestone trimmings, with 450 tons of structural steel framing. The inside finish is light oak with tinted-plaster walls. The executive offices are finished in mahogany. The semi-direct system of lighting with Mazda lamps works perfectly, and a ventilating system has been installed which will insure a supply of fresh air at desirable temperatures in every part of the building. There are electric passenger and freight elevators.

Early in 1914 the old offices at 42 Center Street will be vacated, and the floors in the new building occupied as follows: basement — blueprinting, telephone and telegraph rooms; first, second and third floors divided into office suites; fourth floor—offices in front, with a thoroughly equipped restaurant and kitchen in the rear. On the roof is a railed promenade.

The Pittsburgh Pipe Thawer.

Every winter there is more or less demand upon central stations to thaw out frozen water pipes. This work may be easily and quickly done, avoiding digging up streets, lawns and sidewalks, and customers are learning this. It is a good

Pittsburgh Pipe-Thawing Transformer.

advertisement for the central station and quite profitable, especially if an unusual cold snap happens along.

Formerly pipe thawers were specially made only to thaw pipes, and the investment in them was dead for ten to eleven months out of the year. The Pittsburgh pipe thawer, on the contrary, is a standard transformer and is designed with a standard 110-volt secondary. By reconnecting the secondary terminal board, 55 volts and 27.5 volts can be secured. Therefore, when required to do thawing work, either 27.5 volts, 55 volts or 110 volts is available, this range being sufficient to take care of all average requirements for pipe thawing.

When the season is over, the transformer is connected for 110 volts and may be used as a standard lighting and power transformer. Thus the investment is kept working the year around. The cost of the thawer over a standard transformer is so little that the difference is absorbed at the first cold snap requiring the services of this transformer.

All complications are eliminated in the Pittsburgh pipe thawer. Choke coils, plungers, switches, etc., are omitted. The transformer is small enough to be easily handled on a hand truck. There are two high-tension (usually 1,100-2,200-volt) leads, and two low-tension leads, out of the case.

The changes of voltage are made on the terminal block, which is easily accessible inside the case. The high-tension leads are connected to the primary lines nearest the point of service. Porcelain primary fuse blocks are furnished to protect the transformer against accident. Nothing further is needed but a coil of secondary wire to carry the current from the transformer to the customer's premises.

These thawers are furnished in two sizes: the kilvolt-ampere size will handle many ordinary "freeze ups" and prove satisfactory for a limited use; the 20 kilovolt-ampere size furnishes a capacity that is adequate for all average cases of frozen water pipes. These transformers are specially designed to stand tremendous overload for short periods. They are manufactured by the Pittsburgh Transformer Company, Pittsburgh, Pa.

6,000-Horsepower Motor.

The Engineers Society of Pennsylvania on December 13 visited the plant of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh, to inspect electrical apparatus being built there. The visitors saw the 6,000-horsepower electric motor, made for the Minnesota Steel Company, of Duluth. This machine is 26 feet high and weighs 471,000 pounds. The immense motor will be direct-connected at each end with bevel-gear trains which will drive eight stands of rolls of a 28-inch rail mill. It was designed so that it could be erected complete and tested at the works before shipment.

Another machine which the visitors inspected was the 6,000-horsepower water-turbine-driven generator being constructed for the Alabama Power Development Company.

Sanitary Telephone Booths.

The Louisville (Ky.) Commercial Club has taken up the cudgels against the public telephone booth, which is declared to be a breeding place for germs. The Club will ask the City Council to pass an ordinance on the subject, requiring inspection and disinfection of the booths at regular intervals.

The new Railway Exchange Building, covering an entire block in St. Louis, Mo., has its first seven floors occupied by a department store. The floor area of this store is 30 acres and 9,000 incandescent electric lamps are required for its illumination.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

PANELBOARDS — Crouse-Hinds Company, Syracuse, N. Y.

"Multimeter" metering panels three to two-wire, 125-250 volts, when mounted in suitable slate-lined cabinets.

Approved November 28, 1913.

RECEPTACLES, for attachment plugs—The Trumbull Electric Manufacturing Company, Plainville, Conn.

Flush receptacle, Edison type, catalog No. 1007; 660 watts, 250 volts, for use with Edison type attachment plugs.

Approved October 14, 1913.

RECEPTACLES, Standard — The Bryant Electric Company, Bridgeport, Conn.

"Brya. t" brass-shell, closed or slotted bases.

Key, 660 watts, 250 volts, catalog Nos. "New Wrinkle" 4449-54 inclusive, 4459-60, 4463-64. For use on metal ceilings, catalog Nos. 4461-62.

Approved October 14, 1913.

SHOW-WINDOW DISPLAY FIXTURES—George T. Fielding & Company, East Fordham Road, New York, N. Y.

Advertising display fixtures for use in show windows; 660 watts or less, 110 volts, alternating current or direct current.

The form of a picture representing a man lighting a match, the flicker of which is imitated by an incandescent lamp with contact device placed in a cabinet of which the picture forms the front.

Connection to the supply circuit is made by means of steel-armored pendant cord and approved attachment plug.

Approved July 22, 1913.

SOCKETS, Standard — Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin" brass-shell.

Lever key, 250 watts, 250 volts, catalog Nos. 413, 433, 453, 463, 464.

Pull, catalog Nos. 487-88, 597-99 inclusive.

"Benjamin" porcelain-shell.

Lever key, 250 watts, 250 volts, catalog No. 241.

Approved October 31, 1913.

SOCKETS, Standard—Harvey Hubbell, Incorporated, Bridgeport, Conn.

"Hubbell" brass-shell sockets.

Key, 250 watts, 250 volts. "Lock Shell," catalog Nos. 3658, 3767, 3792, 3794, 35050-52 inclusive; "Quick Catch," catalog Nos. 3664-66 inclusive, 3682, 3758, 3761, 3764, 3770, 3778, 3780.

Keyless, 660 watts, 250 volts. "Lock Shell," catalog Nos. 3649, 3768, 3793, 3795, 35053-55 inclusive; "Quick Catch," catalog Nos. 3667-69 inclusive, 3683, 3759, 3762, 3765, 3771, 3779, 3781.

Pull, 250 watts, 250 volts. "Lock Shell" catalog Nos. 3830-31, 35040; "Quick Catch," catalog Nos. 3760, 3763, 3769, 3775-77 inclusive, 3836-37.

Electrolier brass-shell sockets, for fixture use only.

Key, 250 watts, 250 volts. "Quick Catch," catalog Nos. 3822, 3824, 3827, 3843, 3846, 3849, 3852.

Keyless, 660 watts, 250 volts, "Quick Catch," catalog Nos. 3825, 3828, 3844, 3847, 3850, 3853.

Pull, 250 watts, 250 volts. "Quick Catch," catalog Nos. 3823, 3826, 3842, 3845, 3848, 3851.

Also above types with shade holders attached.

Approved October 14, 1913.

SWITCHES, Automatic — Johnson Service Company, Michigan and Jefferson Streets, Milwaukee, Wis.

5 amperes, 250 volts, and 5 amperes, 550 volts, three-pole.

An automatic switch for control of an electrically driven air compressor. All parts are mounted on a slate panel. An excess pressure in the system operates a governor admitting air to a diaphragm which opens the knife switch and disconnects the motor from the circuit. A decrease in pressure automatically closes the motor circuit. A coil spring on the operating rod produces a quick make and break.

Approved October 15, 1913.

SWITCHES, Automatic—Reynolds Electric Flasher Manufacturing Company, 631 West Jackson Boulevard, Chicago, Ill.

"Reco" one-day time switch, 10 amperes, 125 volts.

A time switch designed for opening a circuit at a predetermined time. The device consists of an alarm clock and double-pole knife switch with tripping mechanism mounted in a cast-iron cabinet.

Approved October 30, 1913.

SWITCHES, Combination Cutout—Detroit Fuse & Manufacturing Company, 1400 Rivard Street, Detroit, Mich.

"Detroit" iron-clad switches. These devices are so designed that all current-carrying parts are inclosed in a metal case. The switches may be operated without opening the case or exposing the operator or outside objects to live current-carrying parts.

Spring-actuated, double-pole, double-break plunger-type switches with cartridge-inclosed fuses. When the case is open the fuse terminals are "dead," eliminating the possibility of shock to the operator in replacing or inspecting fuses.

0-200 amperes, 250 volts, catalog Nos. 6351, 6451, 7251, 7251-L, 7251-P, 7251-K-4 7251-W-C, 7251-L-3, 7252, 7252-L, 7253, 7254, 7351, 7351-D, 7352, 7352-B, 7353, 7354, 7451, 7454, 8251, 8251-Y, 8252, 8253, 8351-53 inclusive.

Sealable service switches, two and three-pole, 30 amperes, 125 volts, catalog Nos. 4211-E, 4311-E, with Edison plug-fuse cutouts; catalog Nos. 4211-O, 4311-O, with link-fuse terminals.

Approved November 17, 1913.

SWITCHES, Fixture—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" 0.5 ampere, 125 volts.

Candelabra candle, pull, catalog No. 420.

Candelabra candle, turn, catalog No. 455.

"Bryant" 3 amperes, 125 volts, 1 ampere, 250 volts.

"New Wrinkle" candle, key, catalog No. 425.

"New Wrinkle" candle, pull, catalog No. 426.

"New Wrinkle" candle, turn, catalog No. 453.

"Wrinklet" candle, key, catalog No. 449.

"Wrinklet" candle, pull, catalog No. 450.

"Wrinklet" candle, turn, catalog No. 454.

Approved November 17, 1913.

SWITCHES, Fixture—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H" canopy switch supplied by manufacturer with rubber-covered fixture wire permanently secured to switch terminals.

Single-pole, 3 amperes, 125 volts, 1 ampere, 250 volts.

Catalog Nos. 7157-58.

Approved October 15, 1913.

SWITCHES, Push-Button Flush—Manhattan Electrical Supply Company, 17 Park Place, New York, N. Y.

Single-pole, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 5080.

Double-pole, 10 amperes, 250 volts, catalog No. 5081.

Three-way, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 5082.

Four-way, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 5083.

Also above types with lock attachment.

Approved October 14, 1913.

SWITCHES, Rotary Flush—Perkins Electric Switch Manufacturing Company, Bridgeport, Conn.

Double-pole, 30 amperes, 250 volts, catalog No. 2568 with plate catalog No. 2569.

Also above type with lock attachment.

Approved October 30, 1913.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

MILAN, KANS.—C. F. Linn will install an electric light plant to light the town.

NORTHFIELD, MINN.—The Council plans to extend the street-lighting system. C.

WAUKEGAN, ILL.—Mayor J. F. Biddinger is interested in a plan to install ornamental lighting on certain streets. Z.

BOWLING GREEN, FLA.—W. T. Sauls is planning to install a plant and to furnish electric lighting here.

FAIRMONT, N. C.—$10,000 will be expended in constructing an electric-light plant. Address the town clerk for particulars.

THAWVILLE, ILL.—The Council is planning ways and means to secure electric lighting. Address the city clerk.

BEEBE, ARK.—A. C. Ward Electric Company is planning to extend the electric-light system to Cabot, Ward, McRae, and other towns.

OCALA, FLA.—J. D. Robertson is planning to construct a hydroelectric plant at Stokes Ferry on Withlacoochee River to cost $300,000.

MUSCATINE, IOWA.—The Council has directed Prof. J. B. Hill of the State University to prepare estimates for the proposed electric plant.

WARWICK, N. D.—F. E. Corson, of Fargo, N. D., is reported to be interested in a project to establish a light, power and heating plant here. Z.

CANTON, O.—The United Engineering & Construction Company, of Cleveland, will soon submit plans for a municipal light plant to Mayor Turnbull.

DENNISON, IOWA.—The Council is planning ways and means to purchase and improve the present electric plant. Address the city clerk.

GILLESPIE, ILL.—The City Council has instructed its light committee to devise a way to secure better street lighting in the business section. Z.

HARDIN, KY.—A. L. Griffith & Son will install an electric light plant in connection with which an ice factory will probably be operated. G.

ARANSAS PASS, TEX.—Voters of the city have approved a proposition to issue $8,000 in bonds for the improvement of the electric light plant.

EAST MOLINE, ILL.—The Board of Improvements plans to provide additional street lamps. Address the clerk of the Board of Local Improvements.

ALLENDALE, S. C.—The J. B. McCrary Company, of Atlanta, Ga., has prepared plans for a waterworks and electric-lighting plant here to cost $25,000.

TOLEDO, O.—The construction of high tension transmission belt line around Toledo by the Toledo Railways & Light Company will be started next spring.

WHITESBURG, KY.—William E. Kilgore will install an electric-light plant. It was recently reported that the municipality was preparing to create a franchise. G.

LENA, WIS.—The Lena Electric Light & Power Company has been incorporated, capital stock $5,000, by J. N. Bossett, O. W. Brazeau, Adolph H. Dionne, and Dennis Dionne.

EDGEMONT, S. D.—The Edgemont Electrical Light & Power Company has been incorporated with a capital stock of $25,000 by Albert Herman, Thomas Colgan and others.

PITTSBURGH, PA.—The Director of Public Works has been authorized by the City Council to install a low-light system in Grandview Avenue from Wyoming Street to Republic Street.

PITTSTON, PA.—An ordinance was adopted by the City Council, granting a franchise to the Pittston City Electric Company, which is at present known as the Citizens Electric Illuminating Company. N.

WILMINGTON, N. C.—The City Council is planning to engage J. B. McCrary Company of Atlanta, Ga., to make a survey, estimate cost, and submit report on the construction of an electric plant.

BARBOURVILLE, KY. — This city is considering the installation of an electric light system to cost in the neighborhood of $15,000. The clerk of the City Council can furnish details. G.

BARSTOW, FLA.—The City Council adopted an ordinance authorizing a loan of $6,000 to extend the "White Way," and $20,000 to repair and enlarge the electric-light and power plant. Address the city clerk.

HOMEDALE, IDAHO.—C. M. Hill, D. F. Sullivan, and others recently organized and incorporated the Homedale Water, Light & Power Company, capitalization $150,000. Homedale is given as principal place of business. O.

WEIDPORT, N. Y.—The Weidport Electric Light Company plans to secure electric current from the Niagara Power system. An estimate of the cost of building the village plant was given by Engineer Smith as $13,000.

EAU CLAIRE, WIS.—Transmission lines may be built from here to Fall Creek, Augusta and Fairchild if enough power will be used by these villages to warrant the plan. George B. Wheeler is local manager. C.

RIVERDALE, MICH.—Plans are being made to install a water-power lighting plant here and supply lights and power for this village, Elm Hall, Vestaburg, Sumner and Elwell. Address H. S. Conner, manager, for particulars.

SAYREVILLE, N. J.—The Township Committee is planning for the installation of a new 40-candlepower street-lighting system in the Morgan Heights section. The Jersey Central Traction Company is negotiating to make the installation.

AUGUSTA, GA.—The Street Lighting Committee of the City Council has authorized the Augusta Aiken Railway & Electric Corporation to install a new and more practical system of arc lighting in the business district on Broad Street.

PIKEVILLE, KY.—The Sandy Valley Light & Power Company will install new equipment for the purpose of changing its production from direct to alternating current. New street-lighting equipment will also be needed. G.

VIRGINIA, MINN.—St. Louis Power Company will soon begin the construction of a transmission line to Biwabik. This same company is negotiating with the Aurora City Council for lines to that place. A consulting engineer has been engaged. C.

PERHAM, MINN.—The Council has appointed Amos Marckel, Dr. Berthold and others, as a committee to investigate the feasibility of repairing and enlarging the present power plant or buying electricity from outside parties. C.

MOUNT VERNON, KY.—The Mt. Vernon Electric Light & Ice Company is being organized and will establish an electric light plant and ice factory. The officers of the company will be U. G. Baker, president, and James Maret, secretary. G.

KEWANEE, ILL.—H. L. Throop, representing the Municipal League at a mass meeting, stated that an estimate had been received for the installation of a new municipal electric light plant which would cost $66,310. This figure includes 38 miles of pole lines.

PHILADELPHIA, PA.—A special type of red lamp inscribed with the words "Fire Alarm" will be installed throughout the city to indicate the location of fire-alarm boxes. By the end of December Chief of the Electrical Bureau Pike expects to have 500 such lamps installed.

PHILADELPHIA, PA.—It is likely that the Philadelphia Electric Company will be asked by the Department of Public Works of this city to supply tungsten lamps in place of the 20,000 gasoline lamps now being used for the lighting system. The contract will cover the year 1914.

JOHNSTOWN, PA.—Application has been made for a charter for the Barnesboro-Spangler Electric Light Company. The move is believed to be a step toward the consolidation of the Barnesboro and Spangler plants now controlled by John Barnes, Ernest Clark and Harry E. Bird.

FORT SMITH, ARK.—That Fort Smith may some time in the not distant future own and operate a muni-

cipal electric light and power plant, is the promise of the new municipal enterprise which has grown out of the ownership and operation by the city of the waterworks system.

CEDAR RAPIDS, IOWA.—Commissioner Zika has given notice that about the first of the year he will introduce a resolution ordering all electric wires in the downtown district to be placed in underground conduits. All the corporations must place their wires underground within 90 days from the serving of the notice.

REDLANDS, CAL.—There is little doubt of the granting of the application of the Coachella Ice & Electric Company to build an electric power transmission line from Banning to El Centro, a sub-station and distribution system at Coachella and issue $300,000 of bonds for building the Coachella plant.

CEDAR RAPIDS, IOWA.—Citizens here have voted to issue $125,000 in bonds to build a dam across the Cedar River. The Iowa Railway & Light Company will light the city for 23 years. Estimates for the dam have been prepared by Hendricks and Cochrane, of Kansas City, Mo. Work will begin in the spring.

LA SALLE, ILL.—The Peru Gas & Electric Company has been incorporated with capital stock of $750,000 to sell electricity and gas for light, heat and power. The incorporators are H. J. Vance, purchasing agent for the Illinois Traction System or McKinley lines, James Knowlton, attorney for the company ,and R. F. Carley, the chief operating engineer. Z.

PORTALES, N. M.—The Portales Utilities Company has decided to improve and enlarge its central power plant here and add about 25 new wells to those which it will supply with power next year. Thirty miles of transmission lines will be constructed. It is planned to complete the additions and improvements by March 1, 1914. A. A. Rogers is president of the company. D.

ARKADELPHIA, ARK.—The Arkansas Power Company, a $500,000 corporation to develop hydroelectric power plants at Arkadelphia, Malvern and elsewhere throughout the state, has been incorporated. The company is incorporated at $500,000, with H. C. Couch, J. H. Meek, J. L. Longino, W. C. Ribenach and C. S. McCain, John R. Hampton, J. W. Lee, as incorporators.

PALO ALTO, PA.—The Eastern Pennsylvania Railways Company, which operates 100 miles of trolley road from Orwigsburg through Pottsville, as the converging point of many lines on to Tamaqua, Lansford and Mauch Chunk, has completed plans for the erection of a $350,000 power house at Palo Alto, a suburb of Pottsville. This will be an addition to the $1,000,000 plant now in operation at the same place.

CENTRALIA, WASH.—The County Commissioners of Lewis County recently granted to the Washington Public Service Corporation a franchise to erect a line of poles and string electric transmission wires on the old Chehalis Road, and about Harrison Avenue. It is reported the company intends to bring electric current here from the immense water power plant at White Salmon on the Columbia River. By the terms of the franchise the corporation must be prepared to furnish electric power within one year. O.

LOGAN, W. VA.—The Ohio Valley Company, a Delaware corporation, has been organized for the purpose of building a steam power plant at Logan, W. Va., for the service of the coal mines. The company is backed by New York and Toledo capital, it is stated, and will begin the construction of the plant within 60 days. Godfrey M. S. Tate is manager here and will be in charge of the construction of the plant. It is intended ultimately to have a capacity of 30,000 kilowatts, but it will start with two 5,000-kilowatt turbines, adding to the equipment as the demand for power increases. The Logan coal field, which will be served, is one of the most important in the West Virginia mining section. G.

HARRISBURG, PA.—The State Department has issued 10 charters to electric light companies to operate in Schuylkill County and this has again started the rumor that a plan is on foot to form one large electric power combine in that county which will get its power from the coal culm about the mines in the vicinity. The Eastern Pennsylvania Light, Heat & Power Company, which now supplies many communities in Schuylkill County, has within the last year merged newly chartered companies and it is rumored here that the latest companies to be chartered will later be taken into this corporation. Charters for six other electric plants have also been issued for Bucks County interests and the incorporators are the same men who have been taken out charters for companies in practically all of the boroughs and townships in that county.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

SALT LAKE CITY, UTAH.—The Montana State Telephone Company will extend its lines to Ely.

COLUMBIA, TENN.—The Cumberland Telephone & Telegraph Company, of Louisville, Ky., will build an exchange.

INEZ, TEX.—The Farmers Telephone Company has been incorporated by H. C. Klein, W. H. Hutchinson and L. C. Noll.

GLADSTONE, ORE.—The Oregon City & Farmers' Independent Telephone Company has been granted a franchise in this city.

HAMPTON, S. C.—The Home Telephone & Telegraph Company has been incorporated with a capital stock of $20,000. S. A. Agnew is president.

PINE RIVER, MINN.—The Farmers Mutual Telephone Company has been organized and will build to Horseshoe Lake. N. D. Sherwood is president.

SADIEVILLE, KY.—The Eagle Telephone Company has been incorporated and will establish a telephone line. M. D. Sanford is president. G.

ROCHESTER, WASH.—The Co-Operative Telephone Company, of Rochester, will immediately begin the construction of a new line west from Centralia, according to reported plans. O.

LINDSAY, KY.—The Cumberland River Telephone Company has been organized by James Lawn, Philip Fox and others, and will build a telephone line. G.

ELGIN, N. D.—The North Dakota Independent Telephone Company will extend its lines from Plaza to Parshall and will put in an exchange at the latter place.

ZEPP, VA.—The Cedar Creek Telephone Company has been incorporated with a capital stock of $5,000 by C. M. Orndorrff, president, and M. L. Swartz, secretary.

DAYTON, WASH.—Patit Co-operative Telephone Company has been incorporated with a capital of $5,000. Roy L. McBride, E. L. Walker and Charles H. Craig are the incorporators.

KENYON, MINN.—Dr. J. A. Gates, owner of the local telephone system, is planning the reconstruction of the entire system in the spring. Open circuit lines will be replaced by a copper metallic circuit. C.

OKLAHOMA CITY, OKLA.—A charter has been granted to the Three Valley Telephone Company, of May. The incorporators are Alpheus E. Price, A. M. Strate and C. S. Burk, all of May. The capital stock is $3,000. P.

NEWPORT, O.—The Newport Farmers' Mutual Telephone Company has been incorporated with a capital stock of $10,000 by A. C. Thompson, George G. Thomas, H. W. Eddy, S. M. Hoff and R. W. Briton.

PRINCEVILLE, ILL.—Keck Telephone Company has been incorporated with a capital stock of $10,000 to conduct and operate a telephone system. The incorporators are W. M. Keck, G. J. Keck and B. H. Hopkins.

HAZLETON, PA.—At the first meeting of the official staff and division managers of the Consolidated Telephone Company favorable action was taken on certain proposed improvements, chief of which was the intention of the company to rehabilitate all of its lines extending from Hawley to Jarrettown, Pa. N.

DILLON, MONT.—The Westside Beaverhead Telephone Company was recently organized here with Theodore Nelson as president, and G. W. Conger, secretary and treasurer. This Company has taken over the former Telephone system here, and has announced that the capacity will be doubled, and some needed extensions made. O.

WILMINGTON, DEL.—The Radio Telephone & Telegraph Company has been incorporated under the laws of that state with a capital stock of $3,000,000. The object of the new corporation is to construct, establish, install and maintain wireless telegraph and telephone apparatus. The incorporators are Herbert E. Latter, W. J. Maloney, and Oscar J. Reichard, all of Wilmington, Del. N.

YORK CITY, PA.—The Commissioners have decided to install a telephone in the law library at the expense of the county. The members of the Board favor a simple system to cost $14,000, while the lawyers want a more complicated system that will cost $19,000. It is expected that the system to be recommended by the Court will be purchased. Address Fred S. Bartenschlager, County Comptroller, for information.

ALPENA, MICH.—Stockholders of the Onaway-Alpena Telephone Company have authorized the directors of the company to petition the Michigan Railroad Commission to raise $58,000 by bonding for the erection of a new building for the company's Alpena property, the installation of a modern switchboard system, the placing of underground cables in the business section and certain improvements to the Onaway and Gaylord exchanges.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MT. EDEN, KY.—Merchants here are promoting the construction of a traction line between this town and Shelbyville.

BUTTE, MONT.—Mr. Wharton, manager of the street car company, states that lines will be extended to mines in North Butte at a cost of $15,000.

CLOVIS, CAL.—Bids will be received up to January 5 for an electric railway franchise in this city. Application for the franchise was made by F. S. Granger.

MARION, ILL.—The City Council has granted a franchise to the St. Louis & Southern Illinois Railway Company to build and operate an interurban railway through Marion. Z.

OGDEN, UTAH.—The Ogden & Logan Rapid Transit Company will extend its car lines to Huntsville and Logan. Address P. H. Kline, general manager, for information.

WENATCHEE, WASH.—The Chelan County Commissioners have granted a 50-year franchise to Hyman Harris, a local merchant, to construct 35 miles of interurban from Malaga to Leavenworth, in the Wenatchee Valley.

COFFEYVILLE, KANS.—The Citizens have voted to issue $30,000 bonus bonds for building the Coffeyville-Nowata interurban line. The new line will connect in this city with the present interurban road now operating between Coffeyville and Parsons.

MILWAUKEE, WIS.—The Wisconsin Electric Railroad Company has secured options on right of way along Lake Winnebago for the proposed interurban extension from Oshkosh to Neenah and Menasha. Construction work will be started on July 1, 1914. H. F. Whitcomb, of Milwaukee, is president of the company.

SPRINGFIELD, ILL.—The Tazewell County, Illinois, Traction Company has been incorporated with a capital stock of $2,500, and will build from East Peoria by way of Pekin and South Pekin to the south line of Tazewell County, and from the Illinois River to Pekin. J. E. Melick, of this city, is one of the incorporators.

SARNIA, ONT.—The Merchants' Mutual Line and other lake package transportation freight companies are interested in plans for an electric railway route through Petrolia to Corunna, with radials to Courtright, Brigden, Arkona and Sarnia. The project is backed by London and Petrolia capitalists, and options for the right of way have already been secured.

DALLAS, TEX.—E. P. Turner and associates, who are promoting the construction of an electric interurban line to extend from Dallas *via* Lewisville to Krum, east of Denton, a distance of 60 miles, have secured practically all the right of way for the proposed right of way, it is announced, and will begin construction work in the early part of 1914. D.

SAN FRANCISCO, CAL.—Bids will be received this month by the Board of Public Works for materials for the construction of the new Municipal Railway lines, including 4,500 tons of steel rails, 71 tons of tie rods, 85 tons of rail spikes, 132,000 tie plates, brace plates and rail braces, 65,500 redwood cross ties, etc. Bids for furnishing 100 cars will also be obtained.

CHICAGO, ILL.—S. M. Felton, president of the Chicago Great Western Railway, who has been examining the affairs and condition of the Boston & Maine Railroad, recommends the consideration of gasoline-electric cars for suburban service, as the cost of operation per mile is about half the cost of locomotive service. Mr. Felton advises the withdrawal of rates now in force.

COLUMBIA, S. C.—The Carolina & Georgia Railway, the interurban project of Jaes U. Jackson and associates, was given the right by the Secretary of State to amend its charter so as to build a branch line between Jonston and Greenwood, thus giving Greenwood entrance by the interurban into Augusta and Columbia. The distance of the branch is 40 miles. James U. Jackson of Augusta is president of the line and F. E. Courtney is secretary.

PROVIDENCE, R. I.—This city is about to inaugurate a system of subways, a Rapid Transit Commission, modeled on that now in office in Boston, being proposed in a report which next month will be submitted to the Board of Aldermen. The Commission is given power to lease or take property by condemnation. The subway systems of Boston and New York have been examined by the special committee, who are soon to report.

SYRACUSE, N. Y.—The Empire United Railways, a part of the Beebee system, electric railway builders in Syracuse, has placed a mortgage on all its properties to the amount of $20,000,000 which will enable it to make extensions of its lines. This mortgage paves the way for the issuance of new bonds, and the proceeds may be used to bring about the fulfillment of the dream of an electric road from Syracuse to Watertown.

KANSAS CITY, MO.—The building of the Twenty-third Street Traffic Way is now up to Kansas City, Mo. The Wyandotte commissioners have their plans and specifications ready to advertise for bids for the work. The plans have been approved by the War Department and the Kaw Valley Drainage Board, and the Kansas side commissioners are ready to join in the public improvement by making necessary concessions regarding streets and grades.

INDEPENDENCE, KANS.—Farmers from Wayside, Havana, Caney, Kas., and Bartlesville, Okla., gathered with the Independent Commercial Association and organized an interurban railway company to be known as the Independence, Caney & Oklahoma Railway Company. In a few hours they raised the necessary money and started the application for a charter on to Topeka. In addition, land owners along the proposed route donated nearly one-fourth of the right of way between Independence and Caney.

OBLONG, ILL.—At a meeting of the stockholders of the Oil Belt Railway Company held in Oblong it was decided to mortgage the property of the company in order to issue bonds in the sum of $2,500,000. The purpose of the bond issue is to secure funds for the proposed extensions of the line which is now operating between Oblong and Bridgeport. It is proposed to extend the line from Bridgeport to this city and from Oblong to Charleston, with possibly a branch extension from Bridgeport east to Vincennes. Address the general manager of the Oil Belt Railway Company.

NEW INCORPORATIONS.

PITTSBURGH, PA.—Westinghouse Gear & Dynameter Company has been incorporated, capitalized at $5,000.

FINDLAY, O.—The Friddle-Cooper Electric Shoe Company has been incorporated with a capitalization of $50,000 by M. W. Friddle and others.

SAN FRANCISCO, CAL.—The Central Electric Company has been incorporated here with a capital stock of $10,000 by W. P. Smith, H. S. Ripley and B. B. Blake.

MINNEAPOLIS, MINN.—Edwards Electric Company has been incorporated with a capital stock of $10,000 by J. O. Edwards, C. P. Edwards and Fred Dexter, all of this city.

KANSAS CITY, MO.—Barber-Dwinnell Electric & Manufacturing Company has been incorporated with a capital stock of $2,000 by R. H. Barber, P. L. Dwinnell and E. L. James.

LANCASTER, PA.—Century Manufacturing Company has been granted articles of incorporation in Delaware to manufacture and deal in electric signs and displays. The capital stock is $100,000.

KANSAS CITY, MO.—The Splitdorf Electrical Company, an Illinois corporation has been granted a charter to do business in Missouri with head office in this city. The state capital will be $10,000. Z.

NEW YORK, N. Y.—Percy K. Hexter, Ronald R. Conklin and Stanley L. Conklin, acting as incorporators, have formed the Ronald Gas-Electric Vehicle Corporation, with $200,000 capital.

SYRACUSE, N. Y.—The Solvay Electric Company has been incorporated with a capital stock of $1,000. The directors are Frank E. Tubridy, Romeyn Wormuth, Clarence E. Cashore and Harry H. Skerritt.

TRENTON, N. J.—The Electric Contracting Company has been incorporated with a capital of $50,000 to manufacture electric appliances. Walter Eldridge, S. Edgar Ellen and Frederick J. Carr are the incorporators. A.

ANDERSON, IND.—Atlas Battery Company has been incorporated with a capitalization of $25,000 to manufacture and sell batteries. The incorporators are M. L. Ashbaugh, R. McCain and C. J. Murray.

NEWARK, N. J.—The Miners' Safety Electrical Lamp Company has been incorporated with a capital of $125,000 for the manufacture of electric lamps for miners' use. Emil O. Bannick, Frederick E. Seiler and Eric Barnes, all of Newark, are the incorporators. A.

LA SALLE, ILL.—La Salle-Peru Gas & Electric Company has been incorporated with a capital stock of $750,000 to maintain and operate electric and gas plants and systems. The incorporators are H. J. Vance, James A. Knowlton and R. F. Carley.

HARTFORD, CONN.—A certificate of incorporation has been filed by the Automatic Machine Company of Hartford, to be capitalized at $2,000. The incorporators are Norman M. Loomis, Frank E. Dodge and Edward S. Pease, all of Hartford.

NEW YORK, N. Y.—Button Bell Manufacturing Company, Incorporated, has been incorporated to manufacture electric bells, appliances, etc. The capital stock is $25,000 and the incorpora-

tors are John McGullam, Robert Logan and Thomas Cassidy. Brooklyn, N. Y.

NEW YORK, N. Y.—William Baker, Incorporated, has been granted articles of incorporation, capitalized at $20,000 to engage in electrical contracting. The incorporators are William Baker, Jersey City, N. J.; Arthur Faust, Brooklyn, N. Y.; and Frederick L. Hartigan, Short Hills, N. J.

MILWAUKEE, WIS.—The Milwaukee Realty and Securities Company has been organized to do the preliminary work for an extension of the Milwaukee Western Electric railway from Fox Lake to Green Lake and from Beaver Dam to Madison. The company, incorporated for $25,000, expects to purchase the 28 per cent of the 74 miles of right of way before construction work begins next spring. A. P. Kletzsch, J. W. Barber, H. C. Kelling, H. J. Janner, G. G. Blatz, F. Dau, O. Loewenbach and W. W. White, Milwaukee; J. Steele and G. Meissner, Oconomowoc, and R. Roll, Hustisford, are the officers of the company.

PROPOSALS.

POWER PLANT.—Sealed proposals in duplicate will be received by the Department of the Interior, Washington, D. C., until January 9, 1914, for remodeling the power plant of the Government Hospital for the Insane at Anacostia, D. C., taking in part payment the old machinery now operating the same. Copies of plans and specifications may be obtained from the Chief Clerk of the Department.

ELECTRIC DRILL.—Sealed proposals will be received at the office of the Purchasing Agent, Post Office Department, Washington, D. C., until December 29 for one electrically driven portable drill for single-phase alternating current at 60 cycles, 110 volts, capable of drilling one-half inch holes in iron or steel and suitable for close corner drilling. Proposals must be signed by bidders and addressed to J. A. Edgerton, Purchasing Agent.

ELECTRICAL APPLIANCES.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until December 30 for furnishing 16 miscellaneous watt-hour meters, to be delivered at the Navy Yard, Key West, Fla., as per Schedule 6,140; until January 13, 1914, for furnishing two motor-driven pressure blowers, to be delivered at the Navy Yard, Portsmouth, N. H., as per Schedule 6,157; and until January 20, 1914, for six five-kilowatt radio sets for ship installation, to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 6,132.

PUMPING UNIT.—The Hebron Commercial Club, Hebron, N. D., has been agitating the question of better fire protection and is in the market for a centrifugal or rotary-cam pumping unit capable of supplying two fire streams of 400 to 500 gallons per minute against a head of 250 feet. The pump is to be direct-connected or geared to a 220-volt, 60-cycle, three-phase induction motor. With this are to be supplied two 2,200-to-220-volt transformers, of capacity sufficient to supply the motor for intermittent duty when connected in open delta. Proposals should be addressed to E. L. Carlton and each proposal should give an alternate bid on the same unit with a 2,200-volt motor without transformers.

FINANCIAL NOTES.

At the annual meeting of stockholders, to be held in Akron, Ohio, January 24 the shareholders of Northern Ohio Traction & Light will be asked to approve an increase in the 6-per-cent preferred stock of the company from $3,000,000 to $5,000,000. All of the $3,000,000 preferred is now outstanding.

The Ottawa Light, Heat & Power Company has increased its authorized stock from $2,000,000 to $2,700,000, and declared a stock dividend of $700,000, payable to stockholders of record March 1, 1914. One share of the new stock will be given for every four now held.

The United Railways & Electric Company has sold to Baltimore banking interests $348,000 first consolidated mortgage 4-per-cent bonds, the proceeds, of which will be used to pay for sixty cars costing $300,000. The cars were bought from J. G. Brill & Company, of Philadelphia, and have all been delivered.

Detroit Edison Company directors, after stockholders had authorized $6,000,000 6-per-cent debenture bonds, decided to offer to shareholders $3,400,000 at par up to 25 per cent of their holdings. A capital increase from $15,000,000 to $25,000,000 was also approved, none of which will be issued at present. The bond proceeds will be used for extensions.

The Milwaukee Electric Railway & Light Company has applied for authority to issue $3,500,000 4.5-per-cent refunding and extension 25-year bonds, dated January 1, 1906. The bonds are part of an authorized issue of $20,000,000, and are to be deposited as collateral, under an authorized issue of $90,000,000 general and refunding mortgage bonds, of which $4,700,00 were issued from August, 1911 to October, 1913, for capital expenditures. Bankers Trust Company is trustee for general and refunding mortgage bonds.

At a special meeting of United Gas & Electric Corporation, held in Hartford, the action of the directors, amending the by-laws of the company to increase the membership of the board of directors from fifteen to twenty-five, was approved. The following were elected to fill the positions created: W. G. Bacon, of Ford, Bacon & Davis; J. G. Gannon, president of the Hibernian Bank & Trust Company of New Orleans; W. P. G. Harding, president of the First National Bank of Birmingham, Ala.; A. H. Wiggin, president of the Chase National Bank; A. J. Hemphill, president of the Guaranty Trust Company; E. M. Kirby, of Wilbes-barre; F. A. Sayles, of Pawtucket, R. I.; R. L. Williams, of Middendorf, Williams & Company, Baltimore; F. V. Hayne, of New Orleans; and S. Z. Mitchell, president of the Electric Bond & Share Company. In a circular to stockholders, President Bullock advised that holders of three-fourths of the common stock of the American Cities Company had accepted the offer to exchange their securities for second preferred and common shares of the United Gas & Electric Corporation, and that the gross receipts of all the subsidiaries in which the corporation is interested now exceed $27,000,000 annually. For this reason it was deemed advisable to increase the membership of the board.

Dividends.

American Power & Light Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable January 2 to stock of record December 23.

American Telephone and Telegraph Company; quarterly of two per cent, payable January 15 to stock of record December 31.

Birmingham Railway, Light & Power Company; dividends of three per cent on both common and preferred stock payable December 30.

Cincinnati & Covington Light & Traction Company; a quarterly preferred dividend of 1.125 per cent, and a common dividend of 1.5 per cent, both payable January 15.

Cincinnati, Dayton & Toledo Traction Company; preferred of 2.5 per cent, payable December 31.

Columbus Electric Company; regular semi-annual of $3 per share on the preferred stock, payable January 1 to stock of record December 22.

Commonwealth Power, Railway & Light Company; the regular quarterly dividend of 1.5 on the preferred and 1 per cent on the common stocks, payable January 2 to stock of record January 16.

Connecticut River Power Company of Maine; the regular semi-annual dividend of one per cent on the common stock, payable January 1, to stock of record December 23.

Consolidated Traction Company of New Jersey; semi-annual of two per cent, payable January 15 to stock of record December 31.

Consumers Power Company (Maine); the regular quarterly dividend of 1.5, payable January 2 to stockholders of record Dec. 19.

Dayton City Railway Company; Common dividend of two per cent, and preferred of 1.5 per cent, payable December 31.

Detroit Edison Company; regular quarterly of 1.75 per cent, payable January 15 to stock of record January 2.

Eastern Michigan Edison Company; regular quarterly of one per cent, payable January 2.

Electric Storage Battery Company; regular quarterly of one per cent on common and preferred stocks, payable January 2 to stock of record December 20.

Halifax Electric Tramway Company; two per cent, payable January 2 to stock of record December 18.

Honolulu Rapid Transit Company; two per cent, payable December 31.

Illinois Northern Utilities Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable Feburary 1 to stock of record January 19.

Illinois Traction Company; quarterly of 1.5 per cent, payable January 1 to stock of record December 15.

Interstate Railway Company; regular semi-annual of three per cent on the preferred stock, payable January 1 to stock of record December 19.

Louisville Home Telephone Company; 1.5 per cent. payable January 2.

Lake Shore Electric Railway Company; 1.5 per cent on first preferred, payable January 1.

Little Rock Railway & Electric Company; a common dividend of five per cent, payable January 1.

Massachusetts Lighting Company,

regular quarterly dividend of $1.75 per share on the old common stock, $1.50 per share on new preferred, and 25 cents a share on the new common, payable January 15 to stock of record December 26.

Memphis Street Railway Company regular quarterly of one per cent on its common and 1.25 per cent on the preferred, payable December 31.

Michigan Light Company; the regular quarterly dividend of 1.5 per cent on the preferred stock, payable January 2 to stock of record December 22.

New England Telephone and Telegraph Company, regular quarterly of 1.75 per cent, payable December 31 to stock of record December 17.

New England Power Company; regular semi-annual dividend of three per cent on the preferred stock, payable January 1 to stock of record December 23.

Northern Ontario Light & Power Company, Ltd.; has declared the regular semi-annual dividend of three per cent on its preferred stock, payable January 15 to stock of record December 31.

Pacific Telephone and Telegraph Company; regular quarterly of $1.50 on the preferred stock, payable January 15.

Public Service Corporation of New Jersey; regular quarterly of 1.5 per cent, payable December 31 to stock of record December 26.

Republic Railway and Light Company; regular quarterly of 1.5 per cent on the preferred stock, payable January 15 to stock of record December 31.

Rome (Ga.) Railway & Electric Company; a quarterly dividend of one per cent, payable January 2.

Shawinigan Water and Power Company, regular quarterly of 1.5 per cent on the common stock, payable January 20 to stock of record January 7.

Springfield & Xenia Railway; 3.25 per cent on the preferred stock, payable December 20 to stock of record December 15, and an initial of two per cent on the common, payable on the same date.

Terre Haute, Indianapolis & Eastern Traction Company; regular quarterly of $1.25 a share on its preferred stock, payable January 1 to stock of record December 31.

Utilities Improvement Company; monthly of 0.5 per cent on the preferred and one-sixth of one per cent on the common, payable January 2 to stock of record December 15.

Winnipeg Electric Company; three per cent, payable January 2 to stock of record December 20.

American Cities Company; the regular semi-annual dividend of three per cent on the preferred stock, payable January 1.

American Public Utilities Company; quarterly of 0.75 per cent on the common and 1.25 per cent on the preferred.

Asheville Power & Light Company; quarterly of 1.75 per cent on the preferred stock, payable January 2 to stock of record December 23.

Bangor Railway & Electric Company; quarterly of 1.75 per cent on the preferred stock, payable January 1 to stock of record December 20.

Boston & Worcester Electric Company; $1 on the preferred stock, payable January 1 to stock of record December 24.

Buffalo General Electric Company; a quarterly dividend of one per cent on the common stock, payable December 31 to stock of record December 20, the same as three months ago, when dividend was reduced from 1.5 per cent to one per cent.

Canadian Westinghouse Company; quarterly of 1.75 per cent and two per cent extra, payable January 10.

Capital Traction Company; a quarterly dividend of 1.5 per cent, payable January 1 to stock of record December 14.

Carolina Power & Light Company; quarterly of 1.75 per cent on the preferred stock, payable January 2 to stock of record December 23.

Cincinnati Street Railway Company; quarterly of 1.5 per cent payable January 1 to stock of record December 16.

Cincinnati Gas & Electric Company; quarterly of 1.25 per cent payable January 2 to stock of record December 13.

Eastern Texas Electric Company; semi-annual of $3, payable January 1 to preferred stock of record December 15.

Demerara Electric Company, Limited; quarterly of one per cent payable January 1 to stock of record December 21.

Fonda, Johnstown & Gloversville Railroad; a quarterly preferred dividend of 1.5 per cent, payable December 15 to stock of record December 13.

Manhattan Railway Company; regular quarterly of 1.75 per cent, payable January 1 to stock of record December 15.

Narragansett Electric Company; quarterly of $1, payable January 2 to stock of record December 15.

New Orleans Railway & Light Company; quarterly of 1.25 per cent on the preferred stock and 0.5 per cent on the common, payable January 1.

Niagara Falls Power Company; quarterly of $2, payable January 1 to stock of record December 2.

Otis Elevator Company, quarterly of $1.50 on the preferred stock and $1 on the common, payable January 15 to stock of record December 15.

Providence Telephone Company; quarterly of $1, payable January 1 to stock of record December 20.

Southern Utilities Company; regular quarterly of 1.75 per cent on the preferred stock, payable December 31 to stock of record December 17.

Toronto Railway Company; quarterly of two per cent, payable January 10 to stock of record December 15.

Trinidad Electric Company; quarterly of 1.25 per cent, payable January 10 to stock of record December 31.

United Light & Railways Company, regular quarterly of 1.5 per cent on the first preferred and 0.75 per cent on the second preferred, payable January 1 to stock of record December 15. Also one per cent cash on the common, payable January 1, 1914.

United Utilities Company; quarterly of 1.75 per cent on the preferred stock, payable January 2 to stock of record December 20.

Washington, Baltimore & Annapolis Railway; quarterly of 1.5 per cent on the preferred stock, payable December 31 to stock of record December 20.

West India Electric Company, Limited; a quarterly dividend of 1.25 per cent, payable January 2 to stock of record December 23.

Western Union Telegraph Company; quarterly of 0.75 per cent, payable January 15 to stock of record December 20.

Reports of Earnings.

AMERICAN PUBLIC UTILITIES.

	1913.	1912.
October gross .....$	221,443	$ 199,978
Net after taxes.....	104,399	101,274
Other income	3,773	.....
Gross income	108,172	.....
Net income	103,163	.....
Surplus after charges..	52,933	.....
Balance after preferred dividends ..	33,363	.....

KEYSTONE TELEPHONE.

	1913.	1912.
November gross .....$	107,332	$ 105,333
Net after taxes.....	55,508	55,04
Surplus after charges..	29,887	29,7
Eleven months gross..	1,158,084	1,110,9
Net after taxes.....	571,846	553.
Surplus after charges..	291,391	276

GREAT WESTERN POWER.

Gross.	October.	Ten Months
Operating revenue ....$	224,893	$ 2,217,987
Net revenue	119,878	1,425,456
Other income	19,900	158,887
Gross income	139,779	1,584,344
Net income	41,211	694,346

The surplus for the ten months is an increase of $293,346 over the surplus for the ten months ended October 31, 1912.

NASHVILLE RAILWAY & LIGHT.

	1913.	1912.
October gross .....$	204,178	$ 180,608
Net after taxes.....	81,382	72,749
Surplus after charges.	41,554	35,755
Twelve months gross..	2,189,888	2,054,354
Net after taxes.....	883,869	878,007
Surplus after charges..	425,402	449,351
Balance after preferred dividends	300,402	324,351

LEWISTON, AUGUSTA & WATERVILLE RAILWAY.

	1913.	1912.
October gross .....$	51,301	$ 51,599
Net after taxes.....	15,233	19,913
Surplus after charges	777	5,513
Twelve months gross..	668,543	612,557
Net after taxes.....	249,283	226,416
Surplus after charges	71,584	53,265
Balance after preferred dividends	35,584	17,265

PORTLAND RAILROAD.

	1913.	1912.
October gross .....$	82,620	$ 79,415
Net after charges...	30,539	25,132
Surplus after charges..	8,828	14,878
Twelve months gross..	1,084,100	972,501
Net after taxes.....	328,103	280,859
*Surplus after charges.	171,910	160,820

*Equal to 8.0 per cent on capital stock.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 22.	Dec. 15
American Tel. & Tel. (New York)	122½	115⅝
Commonwealth Edison (Chicago)	127	127¾
Edison Electric Illuminating (Boston)	236	236½
Electric Storage Battery common (Philadelphia)	46	46
Electric Storage Battery preferred (Philadelphia)	46	46
General Electric (New York)	138	137¼
Kings County Electric (New York)	119	119
Manhattan Transit (New York)	1½	1¼
Massachusetts Electric common (Boston)	10¼	10½
Massachusetts Electric preferred (Boston)	64	65
National Carbon common (Chicago)	134	130
National Carbon preferred (Chicago)	113	110
New England Telephone (Boston)	131	131
Philadelphia Electric (Philadelphia)	25¾	25⅝
Postal Telegraph and Cables common (New York)	77½	77
Postal Telegraph and Cables preferred (New York)	65	65
Western Union (New York)	57½	60
Westinghouse common (New York)	64	63¼
Westinghouse preferred (New York)	112	112

PERSONAL MENTION.

MR. THEODORE N. VAIL, president of the American Telephone & Telegraph Company, has resigned as a director of the Boston & Maine Railroad.

DR. WALTER A. RIGG has announced his resignation as general manager of the Reading Transit & Lighting Company, of Reading, Pa.

MR. H. M. BUCK, who for the past 15 years has been superintendent of the Waukesha Gas & Electric Company, has severed his connection with this company, and MR. C. R. STULL, of Bangor, Me., has been appointed to fill the vacancy.

MR. H. W. YOUNG, president of the Delta-Star Electric Company, will deliver an address on "Moderate-Capacity Outdoor High-Tension Substations" before the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, on December 29.

MR. J. P. H. DE WINDT, who has been connected with the Shore Line Electric Company, which operates electric railways in Connecticut, has been appointed general manager of the Railway Department of the Birmingham Railway, Light & Power Company, a newly created position.

MR. M. S. SLOAN, who has been acting as assistant to Mr. A. H. Ford, president of the Birmingham Railway, Light & Power Company, has been made assistant to Mr. J. S. Pevier, vice-president of the New Orleans Railway & Light Company and chairman of the Executive Committee of the American Cities Company.

MR. ARTHUR ALLEN MARSTERS, secretary of the American Telephone & Telegraph Company, New York City, was married on December 18 to MISS KATHERINE LOUISE VAIL, niece of Theodore N. Vail, at Lyndonville, Vt., where Miss Vail has made her home with her uncle since her childhood. Mr. and Mrs. Marsters will reside in Morristown, N. Y.

MR. JOHN B. TAYLOR has opened an office and laboratory at 23 Lowell Road, Schenectady, N. Y., and also an office at 100 Broadway, New York City, to act as consulting engineer on technical investigations, tests, inspection, and reports on general engineering problems, and also on telephone and telegraph relations of electric light and power systems.

DR. JOHN PRICE JACKSON, dean of the School of Electrical Engineering of Fennsylvania State College, has been named by Governor Tener as one of the members of the new State Engineers' Commission. The Commission has been established to draft a code for government engineers and their qualifications in Pennsylvania. MR. SAMUEL A. TAYLOR, president of the Engineers' Society of Western Pennsylvania, has also been appointed on this commission.

MR. CHARLES B. KELSEY, president of the American Public Utilities Company, of Grand Rapids, Mich., has been unanimously nominated as president of the Association of Commerce of Grand Rapids. Mr. Kelsey, who is also vice-president of the Commercial Savings Bank of Grand Rapids, is widely known not only as a banker and through his connection with the American Public Utilities Company, but for the active interest he has always taken in matters pertaining to the betterment of his city and state.

MR. NORMAN M. CRAWFORD, of Youngstown, O., has been appointed president of the Reading Transit & Light Company, Reading, Pa., vice MR. WILLIAM B. BARSTOW, resigned. Mr. Crawford has been interested in public utility corporations for a number of years and of late has been at the head of the Republic Railway & Light Company, an Ohio corporation. He was also president of the Hartford Street Railway Company, which was taken over by the New Haven system.

MR. WILLIAM J. NORTON and MR. PAUL P. BIRD, both of Chicago, on December 15 severed their connection with the Commonwealth Edison Company to engage in private practice as consulting engineers, with special reference to public-service properties, under the firm name of Norton & Bird. Special attention will be given to the subjects of rate surveys, preparation of rate schedules, new-business campaigns, public-policy campaigns, preparation of cases before public-service commissions, special investigations and appraisals, examinations and reports. Mr. Norton is a graduate of Cornell University in mechanical engineering of the class of 1902. Soon after leaving school he entered the employ of the Commonwealth Edison Company and later accepted the position of general manager with the Federal Sign System (Electric). In 1907 Mr. Norton was made First Assistant Secretary of the Public Service Commission for the First District of New York State. In 1911 he resigned this position to engage in special rate work in connection with rate revision by the City of Chicago, of the Commonwealth Edison schedule. In 1911 he was made Secretary of the Rate Research Committee of the National Electric Light Association, and later editor of *Rate Research*, which position he still holds. Mr. Norton is the author of several papers and books related to commission regulation, the most recent of which is "The Illinois Public Utility Comission Law and Municipal Ownership Law." Mr. Bird is also a graduate of Cornell University in mechanical engineering, and during the years 1907-1911 was smoke inspector of the city of Chicago.

OBITUARY.

MR. THOMAS D. LOVELL, inventor of improved telegraph transmission apparatus, died in Brookline, Mass., on December 13, at the age of 42. Mr. Lovell had been employed as press dispatcher for many years, handling important news messages in all parts of the country. Interment was at Windsor Locks, Conn.

MR. JOHN HYDE, well known contracting engineer, died on December 18 at his home in Knoxville, a suburb of Pittsburgh, Pa. Mr. Hyde was 47 years of age. He came to Pittsburgh from Trenton, N. J., where he was chief engineer of construction for the Trenton Street Railroad Company. Since his residence in this city Mr. Hyde has been chief engineer of the Phipps conservatories.

NEW PUBLICATIONS.

BUREAU OF STANDARDS FEES.—The Bureau of Standards, Washington, D. C., has issued a fifth edition of its circular No. 6 comprising a schedule of fees for electric, magnetic and photometric tests. The Bureau is not yet equipped for testing electric arc lamps.

PANAMA EXPOSITION.—The Division of Works of the Panama-Pacific International Exposition, to be held in San Francisco in 1915, has issued in pamphlet form the rules and regulations which will govern the erection and use of buildings and the services of water, electricity, gas, steam, etc., in the exposition buildings.

PHASE COMPENSATION.—Val A. Fynn, consulting engineer to Wagner Electric Manufacturing Company, St. Louis, Mo., has published in pamphlet form Part 1 of a series of articles on "Phase Compensation." This has especial reference to single-phase motors, and after explaining what phase difference means, it describes the method of controlling this feature in asynchronous motors.

SPECTRAL RADIATION.—Reprint No. 204 from the *Bulletin* of the Bureau of Standards is entitled "Constants of Spectral Radiation of A Uniformly Heated Inclosure, or So-Called Black Body," by W. W. Coblentz. This describes experiments with the bolometer and spectrometer and gives as a result of the author's experiments the following value for the constant in the radiation formula: $C = 14{,}456$; where $C = 5\lambda_m T$.

PROTECTION ENGINEERING.—Beginning in January, 1914, the publishers of the *Insurance Field* have announced a new practical magazine on fire prevention and allied subjects entitled *Protection Engineering*, with which will be consolidated the Fire Protection Supplement of the *Insurance Field*. The new publication will be an illustrated monthly, edited by A. Irving Brewster at Louisville, Ky., and the subscription price will be $2.00.

FOREIGN TRADE OPPORTUNITIES.

(Where addresses are omitted they may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C. In applying for addresses refer to file number.)

NO. 12,155.—MACHINE TOOLS AND ELECTROTECHNICAL GOODS.—A report from an American consular officer states that a foreign business firm wishes to be placed in communication with American manufacturers of machine tools and electrotechnical goods with a view to obtaining an agency in Germany for such machinery.

NO. 12,169.—WIRELESS - TELEGRAPH STATIONS.—The Central Administration of Posts and Telegraphs, St. Petersburg, Russia, will accept tenders for the installation of wireless-telegraph systems providing for the erection of stations with radius as follows: At Markov, 200 miles; Tigila (Kamchatka), 1,000 miles; Sredne-Kolmynsk, 535 miles; Obdorsk, 670 miles; on the Islands of Sakhalin and Solocetz, 200 miles; Krasnovodsk, 200 miles; Abo and Poti, 400 miles; Skobolevsk, 400 miles.

NO. 12,176.—MOTORS AND DYNAMOS.—A report from an American consul in a European country states that a large dealer in electrical and benzine motors and in dynamos, with branch houses in several cities, desires to act as representative of American manufacturers of such motors and of dynamos. Correspondence should be in German or French. Terms of weights and measures must be given according to the metric system.

DATES AHEAD.

American Association for the Advancement of Science. Annual meeting, Atlanta, Ga., December 29-January 2, 1914.

Independent Telephone Association of America. First annual convention, Hotel La Salle, Chicago, Ill., January 6-8, 1914.

National Independent Telephone Association. Annual convention, Chicago, Ill., January 13-15, 1914.

South Dakota Independent Telephone Association. Sioux Falls, S. D., January 14-15, 1914.

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 15-16, 1914.

Efficiency Society. Annual convention. New York, N. Y., January 26-27.

Western Association of Electrical Inspectors. Annual meeting, Cincinnati, O., January 27, 1914.

Northwestern Cedarmen's Association. Annual convention, Escanaba, Mich., January 27-28, 1914.

American Institute of Mining Engineers. Annual convention, New York, N. Y., February 17-20, 1914.

With the Electrical Manufacturers

Universal Cable Grip Company, 216 West Adams Street, Syracuse, N. Y., has prepared some literature dealing with its Red-Top three-piece drive anchor. The parts of the anchor and its method of installation are clearly shown and described. On a calendar card issued by the company a special offer regarding this anchor is made that should prove of interest to users of such equipment.

Mesta Machine Company, Pittsburgh, Pa., has issued Bulletin K devoted to large gears and mill pinions. This shows a considerable number of gears and pinions of various types, spur, bevel, herringbone, etc., made by the company for heavy mill service. The method of machine molding, cutting and threading the teeth is illustrated and described. Curves of safe loads on cast-steel gears and pinions are given.

Indiana Rubber & Insulated Wire Company, Jonesboro, Ind., maker of the famous Paranite rubber-covered wires and cables, states that the year 1913 was the most successful in its history. Its business this year increased 60 per cent over that of 1912, and the latter year was the best year up to that time. Paranite wires and cables are made to meet all requirements of the new Code specifications and the company's constantly increasing business is the best evidence of the value placed upon its products by users.

American Rotary Valve Company, Chicago, recently supplied, through its Jenney Electrical Department, the complete electrical motor drive and control equipment for the Indianapolis *News*. All of the linotype machines, printing presses, stereotyping, and auxiliary machines needed in printing this newspaper are operated by Jenney electric drive. A full-page advertisement in the Indianapolis *News* with many illustrations of the Jenney electric equipment has been reprinted by the company for distribution to those interested.

The Trumbull-Vanderpoel Electric Manufacturing Company, of Bantam, Conn., has erected a modern and completely equipped factory devoted exclusively to the manufacture of Trumbull-Vanderpoel specialties. These include panelboards, switchboards, cabinets and knife switches. The company has recently prepared a catalog containing 100 pages and showing 300 illustrations of these products. An important feature of this catalog is the marginal thumb index whereby the user can immediately turn to the subject in which he is interested.

pany, 1014 West Congress Street, Chi-

Chicago Fuse Manufacturing Comcago, has issued a new circular dealing with its Union inclosed fuses and cutouts. These range in current capacity from three to 1,000 amperes, and are made for 250 and 600-volt circuits. An interesting table is given showing the percentage of the cost of a new fuse that is saved by sending blown fuses to the company for refilling. In the case of 250-volt fuses these percentages vary from 40 to 70, and for 600-volt fuses the saving ranges from 52 to 70 per cent.

W. S. Rockwell Company, 50 Church Street, New York City, furnace engineer and contractor, issued a large sized book entitled "Rockwell Furnace Service for Industrial Heating Operations." The company designs and constructs furnaces of all kinds to meet the great variety of industrial conditions. Among the furnaces built are furnaces for annealing, assaying, brazing, hardening, enameling, forging, heating, melting, tempering, welding, regenerative purposes, etc. Furnace auxiliaries are also designed and furnished to suit special requirements.

General Electric Company's new administration building at Pittsfield, Mass., was opened last week with a ball and vaudeville performance. The building is of five stories, each floor containing 30,424 square feet, the total floor space aggregating about 3.5 acres. Each floor is lighted with 280 50-candlepower lamps, and the total energy required for the equipment of machinery, testing outfits, etc., will aggregate 1,800 horsepower. The construction is of steel-reinforced concrete, only the floors being of wood. The window sashes and doors are of metal.

H. Northwood Company, Wheeling, W. Va., has issued an artistic catalog of its Luna illuminating glassware. This is a pure alabaster glass that is free from specks and streaks and gives a soft white light akin to moonlight. Something like a score of reflectors of various types of light distribution are shown. There are also several highly artistic Sheffield and Venetian shades, bowls for semi-indirect lighting, ceiling spheres and hemispheres, sanitary glass fixtures, etc. Distribution curves are shown for all of the reflectors and full data given on each design of glassware.

H. T. Paiste Company, Philadelphia, Pa., has issued a most attractive new catalog illustrating and describing no less than 360 of its easy-wiring fittings. Among the new fittings included are adapters for National metal molding, which permit the standard Paiste sockets, rosettes and receptacles to be used on this molding. A complete new line of separable attachment plugs and plug receptacles is listed. There is also a new type of Pin-Tap lets for switches in gangs which cuts down the cost of conduit work in cases where the wires for several circuits run together for a considerable distance. A copy of the catalog can be obtained by anyone interested on application to the company.

Monitor Controller Company, Baltimore, Md., manufacturer of automatic controllers for all kinds of motor-driven machinery, announces the removal of its Philadelphia office to Suite 826 Drexel Building. The company also announces that after January 1 its Boston office will be under the supervision of the Tompkins-Stoddard Company at 77 Franklin Street. Mr. Stoddard, the former representative of the Monitor Company, has become associated with Maurice C. Tompkins in forming the Tompkins-Stoddard Company. Mr. Tompkins is a graduate of Massachusetts Institute of Technology and has a wide acquaintance among consulting engineers and others who are connected with large industrial plants in that territory.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has received an order for 10,000 electric laundry irons. The shipment will weigh 30 tons and will cost $135,000 f.o.b. East Pittsburgh. The company ordering the irons will distribute this shipment to several parts of the country. Recently the Westinghouse company has received orders for electric irons from Europe, Asia, Africa and South America. It is announced that it is not probable there will be any reduction of the working force at the Westinghouse electric plants. The railroad-equipment department has enough orders to keep it working to capacity for several months if no new orders come in. In the small-goods departments the operations are normal.

Maschinenfabrik Oerlikon, Oerlikon, Switzerland, has issued some new publications of which periodic bulletin No. 80 shows 10 oscillograms of a turbo-generator manufactured by this company. All of these oscillograms show strikingly the very close approximation to sinusoidal wave form of these machines. Pamphlet 585, issued by this company, is an illustrated description of its electrolytic apparatus for the electrolysis of water. This apparatus is designed in accordance with the system developed by Dr. O. Schmidt and comprises a series-connected set of individual cells all mounted in a compact equipment. The output of such an apparatus at 40 degrees centigrade is about 167 liters of hydrogen and 83 liters of oxygen per kilowatt-hour.

Alberger Gas Engine Company, Chicago and Granger Streets, Buffalo, N. Y., announces that it has concluded a contract for the supplying of a complete power plant in the new building of Barnhart Brothers & Spindler, of Chicago, which firm is one of the largest type founders in the country. The new equipment will include gas producer, gas engines, electric generators, switchboard and auxiliary apparatus. Two gas engines of 150 and 75 kilowatts capacity each will be installed. The gas producer will have a capacity of 350 horsepower, and will supply fuel not only for the engines but also for type-casting machines, hardening furnaces, ovens, torches, annealers, etc. Electric motor drive will be used throughout the establishment where mechanical power is necessary.

The Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia, Pa., has issued an interesting booklet entitled "Boosting." This deals with the auxiliary charging of lead-type vehicle storage batteries. It shows that such charging is practicable at quite high rates if the charge is started at a high rate and gradually tapered down. The additional battery capacity that can be obtained by constant-potential boosts is given for various conditions of a battery and for various durations of boosting charge. Three different methods of making boosting charges are described, and the relative advantages of each clearly given. A table of boosting rates suitable for various available times for boosting and for different stages of discharge of a battery is also given.

H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York City, has issued a new booklet describing its J-M Fyro extinguisher. This calls attention strikingly to the extraordinary number of buildings destroyed by fire annually, the enormous property loss and the appalling loss of life in connection therewith. It then sets forth the value of its new fire-extinguisher for use in homes, factories, power plants, garages, etc. This extinguisher is a compact and easily handled device which throws a spray as well as a stream of fire-extinguishing fluid. This fluid instantly volatilizes when coming in contact with the fire and forms a dense combustion-arresting gas; this gas is said to be five times as heavy as air, and on account of its density and weight quickly envelopes the flames. The fluid is a non-conductor of electricity, and is therefore of value in electrical fires. The extinguisher is simple in construction and operation.

Record of Electrical Patents.

Issued by the United States Patent Office, December 16, 1913.

1,081,292. Locomotive Truck. A. F. Batchelder, assignor to General Electric Co. An electric locomotive of the New York Central type.

1,081,300. Method of Testing Electrical Conductors. H. M. Friendly, Portland, Oregon. The testing instrument is arranged for direct deflection and for null methods of observation.

1,081,308 and 1,081,309. Vapor Electric Apparatus. A. McL. Jackson, assignor to General Electric Co. Mercury-vapor tube with special seal for the electrodes in the tube ends.

1,081,330. Apparatus for Vulcanizing Rubber. R. B. Price, Chicago, Ill. Electric heating element in spiral form.

1,081,342. Electric Traction System. L. B. Stillwell, Lakewood, and F. N. Waterman, Summit, N. J. Polyphase power transmission system with single and two-phase trolleys and regenerative braking.

1,081,365. Thermopile. W. W. Coblentz, Washington, D. C. (Dedicated to the public.) Includes a number of joined thermal elements and receivers attached thereto at certain of the junctures, some of the receivers overlapping.

1,081,368. Selector Mechanism. E. B. Craft and A. F. Dixon, assignors to Western Electric Co. Comprises an electromagnetic selective mechanism for setting the controller parts in definite combination and means responsive thereto for actuating a stop device.

1,081,378. Electric-Fixture Support. Freeman, Saratoga Springs, N. Y. A recessed plate for securing brackets to the wall.

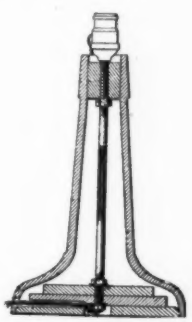
1,081,382. Starting Means for Motor Vehicles. R. Huff, assignor to Packard Motor Car Co., Detroit, Mich. Combined with a throttle valve, a circuit-closer and a governor are connections whereby the valve may be closed and the spark advanced automatically by the governor, and means connected with the starting crank for opening the valve and retarding the spark.

1,081,402. Time Switch. W. E. Porter, assignor to General Electric Co. Covers mechanical details of a double-pole time switch.

1,081,409. Automatic Mail-Carrier. J. M. Schwendemann, Douglas, Okla. A motor-driven car is suspended from the trolley wires.

1,081,413. Electrical System. R. Varley, Englewood, N. J. A combination ignition system.

1,081,414. Electric Heating Element. A. A. Warner, assignor to Lauders, Frary & Clark, New Britain, Conn. The element consists of a self-supporting pliable compound coil made of close helically wound resistance wire which is coiled into a larger and more open helix.



1,081,498.—Base and Stem for Portables.

1,081,433. Automobile Signaling Apparatus. J. L. Cayer, Chicago, Ill. Front and tail electric signal lamps are arranged to show simultaneously intended changes in direction of the car.

1,081,462. Magnetic Chuck. R. C. Patton, assignor to D & W Fuse Co., Providence, R. I. The core of the magnetized coil has several parallel elongated polar projections surrounded by an area of opposite polarity.

1,081,463. Apparatus for Generating Steam. J. B. Pentz, New York, N. Y. Has an electrically heated vaporizing chamber to which water is fed drop by drop.

1,081,490. Device for Muffling Sounds. A. Dare, Philadelphia, Pa. A combination muffler and mouthpiece connected by tubes to a telephone mouthpiece.

1,081,498. Electric-Light Fixture. L. Gudeman, New York, N. Y. A wire duct passing through the stand connects the socket and base block. (See cut.)

1,081,531. Method of Making Storage-Battery Electrodes. H. C. Hubbell, Newark, N. J. Consists in forming a thread-like material from a mixture of powdered nickel or cobalt and their hydroxides, drying the thread, depositing metallic nickel or cobalt thereon and forming a matted cake therefrom.

1,081,550. Electropneumatic Braking System. W. C. Myers, Oakland, Cal. Electrically operated and controlled air-brake system.

1,081,572. Electrical Signaling System. H. Bewlay, assignor to Western Electric Co., New York, N. Y. A three-wire system with a common source of direct and alternating currents.

1,081,580. Lantern. J. R. Cravath, Chicago, Ill. At the bottom of a conical hood inclosing a socket is a flat reflector perforated in the middle to allow the lamp to project through; surrounding the lamp and bearing against the reflector is a glass diffusing cylinder closed at the bottom. (See cut.)

1,081,581. Receptacle for Incandescent Electric Lamps. J. S. Crossley, assignor to Pass & Seymour, Inc., Solvay, N. Y. Has cup-shaped porcelain

body with threaded internal ribs to hold the screw shell for the lamp.

1,081,635. Electrical Means for Producing Sound. O. Stritter, assignor to Akt. Ges. Mix & Genest, Telephon & Telegraphenwerke, Schoenberg-Berlin, Germany. Has an electromagnetically actuated diaphragm.

1,081,641. Alternating-Current Rectifier. E. J. Wiggins, assignor to D. A. Heyman, Chicago, Ill. Includes a motor-driven commutator with special switch.

1,081,646. Illuminating Device. R. K. Witz, Chicago, Ill. An electric sign comprises an elongated housing, lamps and reflectors within it and removable translucent letter panes in the front.

1,081,656. Attachment Plug. A. M. Bradley, Napoleon, O. The screw shell is in two parts pressed apart by a spring which is retracted by squeezing two finger blocks together. (See cut.)

1,081,660. Spark Plug. G. L. Couter, Cumberland, Md. Includes a blade that can be projected between the terminals.

1,081,671. High-Tension Disconnecting-Switch. A. S. Kalenborn and A. J. Pahl, San Francisco, Cal., assignors to K-P-F-Electric Co. Comprises two axially alined petticoat insulators, one of which is rotatable and each of which carries a curved switch arm.

1,081,681. Alternating-Current-Motor Control. D. Larson, assignor to Otis Elevator Co., Jersey City, N. J. Includes inductive apparatus for automatically controlling current to an elevator motor.

1,081,683. Automatic Circuit-Controlling Mechanism for Electrical Self-Starters for Automobiles. W. A. Lurie, Chicago, Ill. A thermostatic switch is placed near the engine for automatically controlling the opening and closing of the circuit for the starting motors.

1,081,693. Electric Pneumatic-Pressure Controller. E. K. Parker, Santa Barbara, Cal. When the pressure on the gauge reaches a certain point the circuit for an electromagnetic valve control is closed.

1,081,696. Magneto-Electric Generator. B. P. Remy and F. I. Remy, Anderson, Ind., assignors to Sumter Electrical Co. Includes a rotary inductor, an armature which oscillates concentrically therewith and an interrupter controlled by the armature position.

1,081,706. Battery-Supporting Cradle for Vehicles. S. G. Thompson, Jersey City, N. J. A battery-carrying frame is slidably mounted in a cradle rigidly suspended from the chassis.

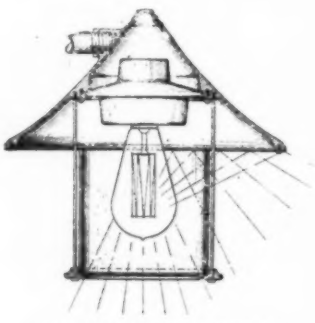
1,081,712. Key Construction and Release for Telephonic Apparatus. W. P. Andrick, E. Lowe and H. W. Haff, Jamaica, N. Y., assignors to General Acoustic Co. Includes a detent for holding the key in either of two positions and a switch hook for releasing the detent when communication is terminated.

1,081,728. Spark Plug. W. L. Edison, Orange, N. J. Consists of a non-conducting core having a conical sparking end and a pair of wires terminating on opposite sides of the apex of the cone.

1,081,729. Heating Coil for Carbureters. W. A. Erkenbrack, Webster, S. D. An electric heating coil is disposed on the bottom of the float chamber.

1,081,731. Device for Starting Internal-Combustion Engines. A. P. Foster, East Orange, N. J. Includes an electric motor, a flywheel and gear, and means for simultaneously engaging the gear and closing the motor circuit.

1,081,749. Electric Distribution System. L. B. Jones, Kansas City, Mo. A combination starting and lighting motor-generator for an automobile with



1,081,580.—Street Lantern.

relay control for connecting the storage battery.

1,081,756. Shade-Holder. N. Krohn, Ill., assignor to Adams & Westlake Co., Chicago, Ill. Has a ring, a number of backwardly extending elastic fingers and a continuous contractile coil spring surrounding the fingers of the ring to prevent the shade loosening.

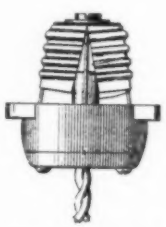
1,081,760. Ignition Dynamo. C. T. Mason, Sumter, S. C., assignor to Sumter Electrical Co. Of the inductor type.

1,081,789. Electric Switch. G. B. Thomas, assignor to Perkins Electric Switch Mfg. Co., Bridgeport, Conn. A canopy pull switch.

1,081,800. Illuminated Sign. R. R. Wiley and W. K. Wiley, Buffalo, N. Y., and W. S. Hough, Jr., St. Catherines, Ont. An electric sign character of transluscent material having the strokes of the character in relief and each with one face prismatic.

1,081,809. Trolley. G. O. Burwell and C. M. Kurtz, Bellevue, Pa. Springs bear against the ends of the wheel axle.

1,081,827. Starting Device for Electric Motors or the Like. W. Griebe, Brooklyn, N. Y. Includes a resistance member in the form of a sliding plunger with graded resistances adapted to



1,081,656.—Attachment Plug.

bridge the gap between the contact bars.

1,081,832. Speed-Controlling Apparatus. J. T. Hume, assignor to Chicago Pneumatic Tool Co., Chicago, Ill. A pair of radial arms carried by the shaft has a pair of centrifugal governor elements pivotally mounted upon them and a circuit-controlling element carried by one of the governor elements.

1,081,843. Indicator. L. S. Larson, Toledo. A ship's ballast indicator includes a ballast tank, a float vertically movable therein, a voltmeter, a bank of resistance elements connected to one terminal of the circuit and a contact member actuated by the float.

1,081,884. Burglar-Alarm. E. C. Bertagnolli and F. W. Bertagnolli, Central City, Colo. Includes a special contact-making plug.

1,081,912. Smelting-Furnace. K. O. E. Olausson, assignor to Trollhättans Elektrothermiska Aktiebolag, Stockholm, Sweden. An electric furnace with a liquid-seal condensing chamber outside of the furnace.

1,081,925. Railway Signaling System. A. V. T. Day, assignor to Hall Switch & Signal Co., New York, N. Y. A combined electric traction and traffic controlling system.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 22, 1913.

573,464. Electric Arc Lamp. E. P. Hopkins, New York, N. Y.

573,485. Process of and Machine for Magnetic Separation. R. H. Sanders and C. T. Thompson, Philadelphia, Pa.

573,493. Electric Battery. A. E. Stephenson, Chicago, Ill.

573,496. Apparatus for Preventing Collisions on Electric Railways. B. C. Tolghman, Jr., Philadelphia, Pa.

573,526. Electric Arc Lamp. C. H. A. H. R. Van Nollendorf, Vienna, Austria-Hungary.

573,558. Electrical Resistance Device. D. C. Voss, Malden, Mass.

573,575. Telephone Exchange System. W. W. Dean, St. Louis, Mo.

573,576. Common-Battery Telephone System. W. W. Dean.

573,581. Electric Engine. I. T. Dyer, Chicago, Ill.

573,591 and 573,592. Electric Signaling Apparatus. F. B. Herzog and S. S. Wheeler, New York, N. Y.

573,601. Electrical Switching Apparatus. F. W. Jones, New York, N. Y.

573,612. Electrical Connecting-Cord. C. H. McEvoy, Lowell, Mass.

573,617. Electric Arc Lamp. P. F. H. Queisser, Charlottenburg, Germany.

573,629. Electric Heater. H. L. Tyler, Corning, N. Y.

573,645. Automatic System of Distribution and Control for Electric Railways. W. H. Cooley, Brockport, N. Y.

573,647. System for Generating and Distributing Electrical Energy. C. M. Green, Cleveland, O.

573,670. Regulator for Electric Heaters. A. D. Lagrelle, Louvres, France.

573,716. Electric Signal-Operating Device for Railway Trains. G. F. Singer and F. K. Singer, Mingo Junction, O.

573,723. Electric Floor-Push. H. C. Thomson, Boston, Mass.

573,807. Electric Switch. W. Boardman and H. Boardman, Lancaster, Pa.

573,817. Electric-Light Support. E. J. Fulghum, Traverse City, Mich.

573,819. Electric Railway. P. W. Leffler, Chicago, Ill.

573,820. Electric Elevator. P. W. Leffler.

573,821 and 573,822. Electric Railway. P. W. Leffler.

573,823. Motor-Car Truck. P. W. Leffler.

573,830. Electric Arc Lamp. J. A. Mosher, Chicago, Ill.

ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. LXIII, No. 18 | CHICAGO, NOVEMBER 1, 1913 | Three Dollars a Year

UNIVERSITY OF MINNESOTA
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3,000 "Arrow E" Snap Switches

in special weatherproof fittings control the lights on the new monster battleships *Rivadavia* and *Moreno* of the Argentine Navy. "Arrow E" Snap Switches were specified because the builders of the ships were given *carte blanche* to install the best electrical fittings obtainable.

See page 5 of this Issue for interesting details.

Index to Advertisers Page 86

ALLIS-CHALMERS

Self-Cooled Transformers

have this distinctive feature

The transformer tank, made of heavy boiler plate, is surrounded by one or more jackets connected to it at both top and bottom by tubular openings which permit a constant circulation of oil.

The joints of both the tank and jacket are thoroughly welded, making them absolutely oil tight and giving a very strong mechanical construction.

The annular spaces between the tank and jackets serve as flues, providing a large and rapid circulation of air, which readily diffuses the heat losses.

With this construction self-cooled transformers can be built in large sizes and low operating temperatures are assured.

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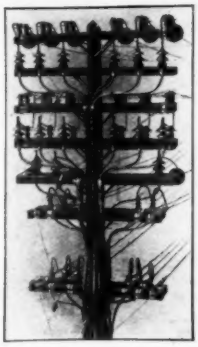

What do you think of this Pole?

It shows how a large light and power company solves the problem of connectnig a number of lead-covered cables to their aerial extensions.

Note the complete protection to cable ends afforded by using

D. O. A. (Davis Open Air) Cable Terminals!

It pays to insure your cable systems against insulation burn-outs and faults at the ends by using these terminals.

If they cost more than other makes, the difference is in the superior protection afforded.

Write our nearest office for a copy of our new D. O. A. terminal bulletin—28 pages of valuable data.

Standard Underground Cable Co.
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Boston San Francisco St. Louis

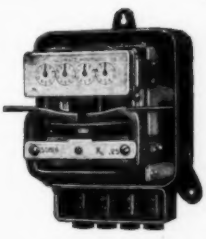
For Canada: Standard Underground Cable Co., of Canada, Limited, Hamilton, Ont.

DUNCAN PRODUCTS

Are Exceptionally Popular

TRANSFORMER

D. C. METER



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DUNCAN ELECTRIC MFG. CO.
LAFAYETTE, IND.

Quality Is Proved by Success

Our Power Plant Specialties are designed with a thorough knowledge of the most exacting central-station service conditions.

Outdoor Pole Top and Station Disconnecting Switches in all capacities and voltages, Cable End Bells, Bus Bar Supports, Inverted Suspension Supports for both pipe and flat mounting, Switchboard and Pipe Frame Fittings, Clamp Insulators, Station Pins and many other High Tension Specialties.

Suitable designs for any special conditions. You are assured of our responsibility by our Five Year Guarantee.

Send for our Blue Catalogue and Pole Top Switch Bulletin 100.

Electrical Engineers Equipment Co.
10-12 N. Desplaines Street Chicago, Ill.
Northern Electric & Mfg. Co., Limited, Canadian Agents
Western Electric Co., Distributors

COOK NEW WEDGE SPLIT Insulator

Carefully manufactured from hard white porcelain. No burrs or rough edges to cut insulation. Cap needs no centering when screwed into place.

Trial Orders Packed 500 in a Box—Send for Sample

Cook Pottery Company Trenton, N. J.

MICA FOR ELECTRICAL AND MECHANICAL PURPOSES

INDIA—AMBER—DOMESTIC

Any size, shape, pattern, grade; rough trimmed, rectangular cut, washers, discs, rings, cones, tubes etc. For every use of mica we are prepared to submit samples and prices of qualities best suited to requirements. We can "show you." Write!

EUGENE MUNSELL & CO.

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2

NEW RULES

forbid soldered joints for wires in wooden molding. Here is the "approved" fitting Paiste provides for making a "branch." The line covers all possible fittings: 2- and 3-wire single and double branches; also Cross-overs and Straight-thru Connectors. No Cutting of molding, and, of course, no splicing of wires. Enough saved in making one branch to more than pay for the fitting. Sample sent if you need it, and how about our bulletins? Are you on the list?

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H. T. PAISTE CO., Philadelphia, Pa.

NEW YORK :: BOSTON :: CHICAGO

"UNION" KEY SOCKETS

embody the only improvement made in key sockets in years. The porcelain part has been especially strengthened. Our method of attaching shell and cap is not approached by any other type; it permits instant changing of shells. N. E. C. Standard, Edison Base, 250 volts.

"Union Made Means Well Made"

Send for Prices and Samples

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Hamilton Ave. Trenton, N. J.

"Beats any Baking Varnish I ever saw"—That is what we frequently hear from Master Mechanics and Shop Foremen, after they have tested out our Baking Varnish. Costs no more than other Varnishes. Let us submit sample.

P & B

Baking Varnish—Clear or Black
Black Finishing Varnish—Oilproof
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Also the old P & B Compound and P & B Tape that you have always used.

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The Standard Paint Co.

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USERS Say USEM

Push Buttons are BEST. Cost Little to Install and Nothing to Maintain.

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USEM CO., 223 West 33d Street, NEW YORK

Panel Boards and Steel Cabinets, Meter Control Panels, Switchboards

Knife Switches Front Connected Back Connected

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FRANK ADAM ELECTRIC CO., St. Louis, Mo.

WILLARD STORAGE BATTERIES

For ALL PURPOSES

Manufactured by THE WILLARD STORAGE BATTERY CO.

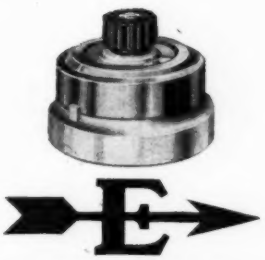
CLEVELAND, - OHIO

The Argentine Republic's new battleship, the Rivadavia, upon her recent trials off the coast of Maine, proved to be faster than any ship in the American navy, and than all save one in the British navy. The Fore River Ship-building Corporation, her builders, contracted to give the Rivadavia a top speed of 22.50 knots. In the five-mile trial run she made an average speed of 22.567 knots. The British battleship Neptune made 22.7 knots. But, of American ships, the dreadnought Delaware falls slightly below the Rivadavia with 21.56 knots. A sister ship to the Rivadavia, the Moreno, is in progress of construction. The two will have 500 tons greater displacement than anything in the American navy. But the Pennsylvania and No. 39, two battleships not yet in commission, will have a considerably larger displacement.

—*COLLIERS'*

Built Like a Battleship

"Arrow E" Switches were specified for use on the super-dreadnoughts *Rivadavia* and *Moreno* of the Argentine Navy because the switches are *built like a battleship.* Ready for instant action; dependable under all circumstances; invulnerable to attack as human ingenuity can make them;—"Quality and Service" are the dominant characteristics of "Arrow E" Switches.



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560-562 West Monroe St., Chicago
579 Howard St., San Francisco

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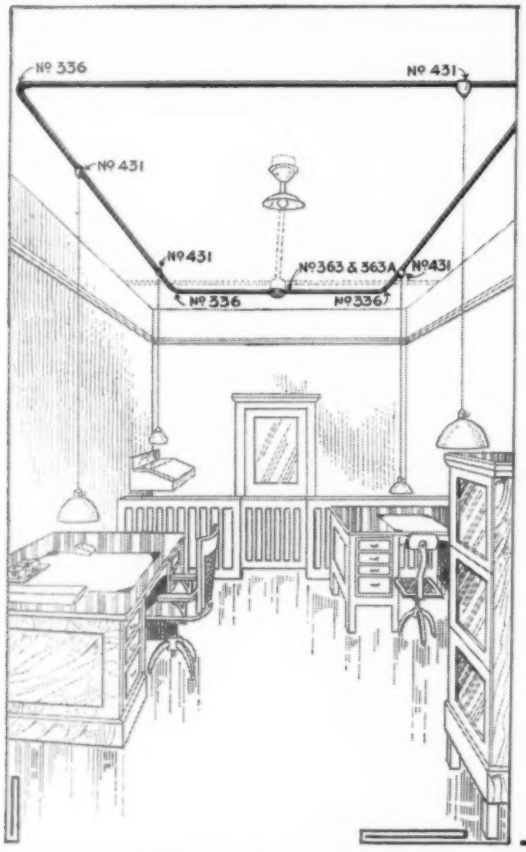


Lighting in The Right Place

It is seldom that the lighting of rented property suits the tenant.

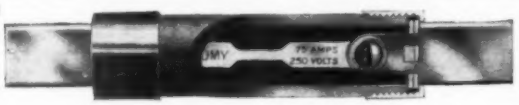
The cut shows one of the many hundred offices where the lighting has been made-over-to-suit with "NATIONAL" Metal Molding.

The circuit was picked up in this instance at a conduit junction box with "NATIONAL" Adapter Plate No. 363 and Cover No. 363a and the ceiling panelled with molding located 18 inches from the sidewall. Four No. 336 Flat Elbows and four No. 431 Rosettes were used. The whole job painted to match the ceiling.

It not only made a good job but looked it.

National Metal Molding Co.

PITTSBURGH, PA.



"Look for the Gray Shell"

Light and Power Companies, Large Corporations, Industrial Plants, Mining and Smelting Companies, Department Stores, Hotels, Office Buildings, Electric and Steam Railroads, Steamships, U. S. Government, and many other classes of users are **reducing fuse Maintenance expense over 80 per cent by using**

ECONOMY RENEWABLE FUSES

They use Economy Renewable Fuses for these reasons:

First, of course, because it provides a practical method of reducing the fuse maintenance expense more than 80%.

Second, because it is the only renewable fuse that is uniformly rated.

Third, because it is the only design so far produced that provides the desired electrical characteristics.

Fourth, because all capacities of renewal elements are readily available, making large fuse stocks unnecessary.

Fifth, because they never vent fire or hold a sustained arc and are absolutely safe.

Sixth, because they meet the performance specifications governing the use of such devices.

Special Announcement!

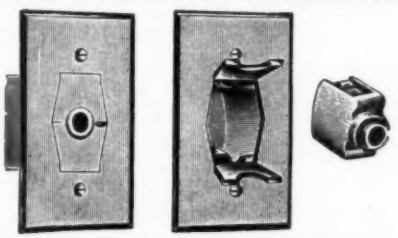
Two Economy Renewal Elements are now furnished (without charge) with each Economy Fuse. Now YOU figure what fuse is the cheapest not only to buy but also to maintain.

Write for Bulletin, Prices and Discounts

ECONOMY FUSE & MFG. CO.

Kinzie and Orleans Streets - CHICAGO

MESCO FLUSH PLUG RECEPTACLE



Over 5000 Specified for use in the New York Municipal Building

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New York	Chicago	St. Louis	San Francisco
17 Park Place	114 S. Fifth Ave.	1106 Pine St.	604 Mission St

Note Protection at Corners

Blake Insulated Staple

Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds.

5 Sizes **Pat. Nov. 1900**

Write for Samples

Blake Signal & Mfg. Co.

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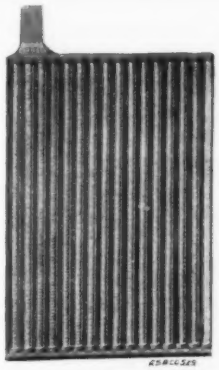


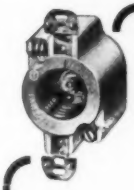
"Ironclad-Exide"

The battery that keeps an electric vehicle in service day-in and day-out

Ample proof in book 1049. A book well worth while. Ask the office nearest you.

THE ELECTRIC STORAGE BATTERY CO.

New York St. Louis Boston Cleveland Chicago Atlanta Detroit **PHILADELPHIA, PA. 1888-1913** Denver Los Angeles San Francisco Portland, Ore. Seattle Toronto



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Revised Lists

Receptacles	$ .30
Plate	.50
Complete	$ .80

All Standards finishes at this List.

Plate and Receptacle packed separately, in Individual Cartons. Duly labeled.

THE TRUMBULL ELECTRIC MFG. CO.
Plainville, Conn.

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SIMPLEX QUALITY

The **Year-Round** Merits of Simplex Products make our Holiday Offerings Self-Sellers.

You can't well overstock on Simplex goods—**they are always first choice.**

We have greatly enlarged our popular Simplex line with new offerings of specially attractive lamp socket devices.

They give you a nice profit margin, and have a strong selling appeal.

Special holiday packing.

Descriptive matter is in the printer's hands, and will be ready for mailing shortly.

SIMPLEX ELECTRIC HEATING CO.
Manufacturers of Everything for Electric Heating and Cooking
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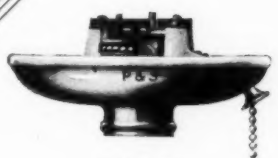
New Outlet Box Fitting



P & S 428

This outlet box fitting has made a hit. Get your orders in early for prompt delivery. Designed for a 4 inch box, but may be used on a 3¼ inch box.

Each receptacle is equipped with 4 inches of chain and 10 feet of cord complete with ball.

Pass & Seymour, Inc.

MAIN OFFICE AND WORKS
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NEW YORK CITY 178 Fulton Street
SAN FRANCISCO Rialto Building
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DENVER SALES AGENTS, B. K. SWEENEY ELECTRICAL COMPANY

"AMERICAN"

Bituminized Fiber Conduit

7 Foot Lengths ⅜ Inch Walls
⅝ Inch Joints
Absorption, 100 Hrs., ¾ of 1%
Puncture Test, 50,000 V.

Compare These Figures With Other Types.

American Conduit Company

East Chicago, Ind. 140 Nassau St., New York

Instead of this old, inefficient and expensive method

Use the Blackburn Adjustable Ground Clamp

and secure this neat, permanent, efficient ground in

One Minute

The old-style wire-wrapped ground costs about 25 cents as you will find if you average up a hundred jobs. With the Blackburn Clamp the work can be done in one-tenth of the time and the contact is permanent without having injured the enamel coating of the pipe, except at the screw point contact. Made in two sizes, adjustable to any pipe. Furnished with a shoe if desired, for use on lead pipe, cable, etc.

Free Demonstrating Sample on request. Write at once.

BLACKBURN SPECIALTY CO.

1126 Prospect Ave., S. E., Cleveland, O.

CUTTERS BEAVER THREADERS

CLEAN CUTS

Did You Ever See a Pipe Cutter with Knives like This?
Knives that cannot break, Automatic Feed, and Rigid Construction make possible Square Cuts and Fast Cutting

Complete Tools	No. 1	No. 5
List	$18.00	$20.00
Cutting Range, Inc.	⅛ to 1 "	⅛ to 2 "
U. S. Shipping Weight	8 lbs.	12 lbs.

Extra Sets Knives	No. 1	No. 5
List	$1.20	$1.50
Cutting Range, Inc.	⅛ to 1 "	⅛ to 2 "
Mailing Weight	2 oz.	3 oz.

Knives give hundreds of cuts without grinding. They are easily ground or we grind them at a nominal charge

90% of all electricians who have seen The Beaver Square End Pipe Cutter have adopted it.

Your Jobber will deliver it on a trial basis. If your jobber does not carry send us your trial order at 50% and mention his name.

WRITE FOR COMPLETE NEW CATALOG

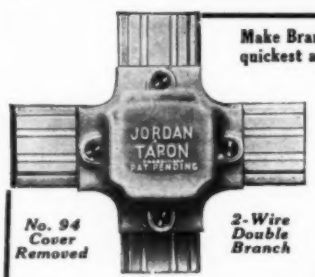
Make all Your Cuts like This

Square, without a Burr

3 Times Faster than Sawing

Department E

The Borden Co., Warren, Ohio



No. 94 Cover Removed

2-Wire Double Branch

Make Branch Taps in Wood Molding Lines quickest and most permanent with

Jordan Tap-Ons

Approved by Underwriters

They increase the efficiency of your workmen by saving time and at the same time perfect jobs are the result. For two or three wire branches or any combinations of same. The porcelain cover overlaps the capping, making a neat and finished piece of work.

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Western Representative,
Messrs. S. R. Fralick & Co., 15 So. Clinton St., Chicago, Ill.

The "Lakin" Hickey

Pipe Sizes, ⅛ and ¼ inch

For short bends in awkward positions. Will not kink the pipe. The threaded end fits a standard one inch pipe coupling. Screw a piece of one inch pipe in the other end of coupling. THE HICKEY DOES THE REST. Never necessary to throw away the Hickey—even if the handle breaks off. Simply unscrew the coupling.

Write for Prices and Discounts

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299 Broadway NEW YORK CITY

"It's the Coating That Counts"

PITTSBURG STANDARD

Pittsburg Standard Enameled Conduit

does not waste the contractor's time, because it never requires re-threading. The threads at both ends are sharp and clean and guaranteed to be of standard gauge.

A smooth, continuously perfect surface of our special formula, high-grade elastic enamel (deterioration proof) forms the "Coating that Counts."

The heavy-wall, soft steel pipe may be bent as required without fear of fracture or injury.

Pittsburg Standard Copper Galvanized Conduit A mild wrought steel pipe, first coated with pure copper, on which the zinc is deposited by electro-chemical action, insuring a uniform coating free from pin holes or other defects. Smooth enameled interior makes fishing easy.

ENAMELED METALS COMPANY

Pittsburg, Pa.

G. M. Gest

Conduit

Engineer & Contractor

Executive Offices
277 Broadway
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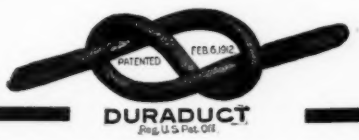
Cincinnati *Chicago* *San Francisco* *Montreal*



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Reg. U.S. Pat. Off.

DURADUCT—

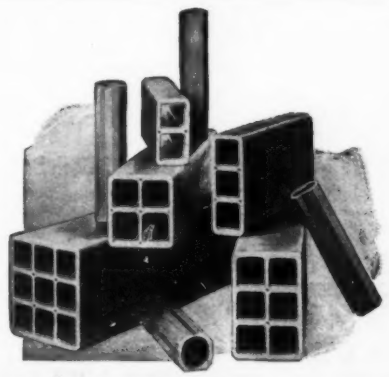
Means a 75% reduction in fishing and a like saving in time, labor and expense.

The conduit with the "roller bearing wireway."

Ask your jobber for sample

TUBULAR WOVEN FABRIC CO., Pawtucket, R.I.

A. HALL BERRY, General Sales Agent
97 Warren Street NEW YORK, N. Y.



THE STANDARD FOR QUALITY

McRoy .·. Conduits .·. Camp

THE PIONEER MANUFACTURERS

Specify either of the above standard makes when writing your underground specifications.

Factories East and West, enable us to figure reduced freight rates, assuring you of the lowest delivered prices without sacrificing quality in any way.

Large stocks of both single and multiple duct constantly carried, thus insuring an early delivery.

Our conduits have been used for twenty-three years. Inquire about us in any city where conduits have been installed.

McROY CLAY WORKS
The Rookery, Chicago

H. B. CAMP COMPANY
New York Pittsburgh Chicago

Save 10% in Breakage and at least another 10% in Labor and Time by using

Patented

One piece is exactly like another—there isn't the slightest difference in a million. It is this feature that saves 10 per cent in breakage alone. If one piece is broken the entire knob is not ruined as is the case in porcelain knobs not possessing the advantage of the interchangeable feature.

FINDLAY INTERCHANGEABLE PORCELAIN KNOBS

Look at the illustrations—they'll tell the story to every practical man who has had the usual trouble with old-style split knobs—100 caps out of every 1,000 knobs broken (and you know that means 100 complete knobs ruined), time wasted in matching caps and bottoms, trouble in centering parts and waste material on account of broken or lost caps.

Here's the new and better way: use Findlay Interchangeable Split Knobs—one part is exactly like the next, therefore each part is interchangeable. Besides this great advantage, they are self-centering and the pieces may be used for straight wiring jobs or cross-overs. The grooves are deep, firmly holding the wire and will not break when installed with wire nails.

Standard package is 1 bbl., 2,200 complete knobs (4,400 pieces). A keg contains 500 complete knobs (1,000 pieces).

One trial order will convince you. Get samples and prices from your supply house or write us direct.

FINDLAY ELECTRIC PORCELAIN CO.

FINDLAY - OHIO

Patented

For Straight Wiring

For Cross-Overs

Simply use longer screw or nail and as many pieces as desired.

Write for Bulletin and Discounts

Columbia Metal Box Co.

226-228 E. 144th Street, NEW YORK

A Radical Departure and Much Needed Improvement

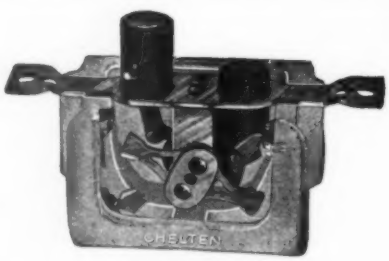
COLUMBIA Push Button Switch Cabinets

Save Cost of Switch Box and Plates.

Push Button instead of knife switches eliminate all danger of accidental contact with live parts, besides assuring longer service, as it is well known that push button switches far outlast knife switches. These new cabinets are much superior to the regular panels and cabinets, they occupy less space and are lower in price. Lock type switches may be substituted for use in public halls, etc. Note the prices. Cabinets only.

		Prices			
Cat. No.	Circuits	List	Cat. No.	Circuits	List
511	2	$3.50	514	8	$5.00
512	4	4.00	515	10	5.50
513	6	4.50	516	12	6.00

CHELTEN ELECTRICAL SPECIALTIES



Pat. May 7, 1912

Our new **Wall Box** is a radical departure from any on the market — no loose screws—ganged in half the time—prices no higher.

Our **1913 Catalog** describing this box together with our full line of **Push Button Switches**, Receptacles, Ground Clamps, etc., is yours for the asking.

Satisfaction guaranteed—Prices interesting

CHELTEN ELECTRIC COMPANY

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San Francisco
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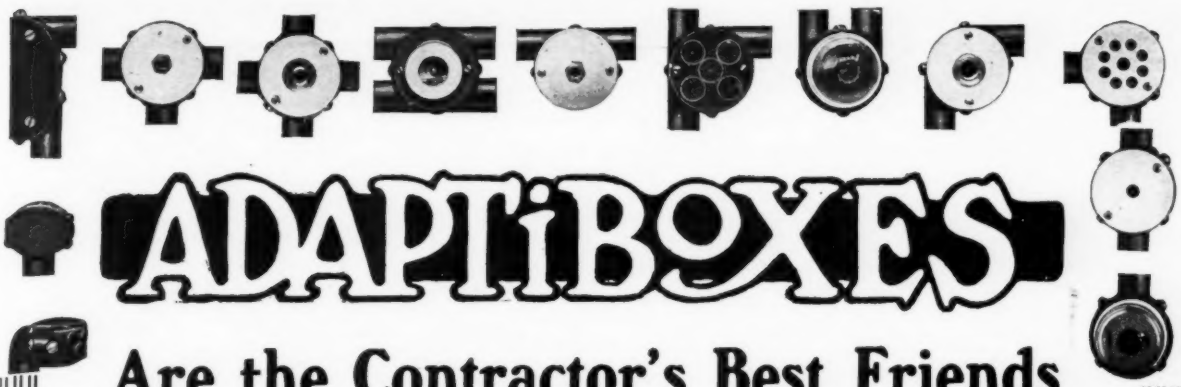

ADAPTiBOXES

Are the Contractor's Best Friends and we can prove it:

Take the item of making changes in existing installations, or LAST MINUTE changes in a present job. With the rigid type of conduit fitting, existing installations must be torn up and the lighting system disturbed; but when ADAPTiBOXES are installed, the change means a change of parts only, and is effected by simply loosening two screws, removing the blank side and inserting the outlet side. No disturbance of the lighting system is necessary, and the changes or additions to the conduit system can be made with the lights burning.

You increase your business by having ADAPTiBOXES installed, as the factory owner is very willing to give orders for changes or additions to the conduit system when he knows that the cost of doing so is slight, and does not mean the tearing up of the system already installed.

Here is the newest ADAPTi Contractor's Help:
ADAPTiBOX for use in Concrete Work

ADAPTiBOX FOR CONCRETE CONSTRUCTION
No. 4 CO, Diam. 4 in., Depth 2 in.
No. 5 CO, Diam. 4 in., Depth 4 in.

This box is made in two pieces, a sleeve and flanged removable bottom section. To install this box, the bottom is removed, the sleeve or box proper placed in position, and secured to the wooden forms by two nails driven through projecting ears provided for same. The conduit connections are then made with bottom or cover off. Four holes are provided in the removable bottom for attaching fixture stud. Fixture studs can also be attached by removing center knockout in bottom, and inserting from back, and bolting same to the removable bottom. After fixture stud has been attached to the removable bottom it is placed in position on the sleeve or box proper, and clamped into position by two screws inserted in the bayonet joint. The use of this box saves time in installing, as it will be readily noted from the foregoing that this type of outlet box can be more easily and quickly installed than the old style or one-piece box.

Get your orders in early for this concrete ADAPTiBOX— the demand is tremendous.

WRITE FOR THE NEW ADAPTi CATALOG TODAY

THE ADAPTi MANUFACTURING CO.
Formerly The Bonnell Manufacturing Co.
CLEVELAND, OHIO

Moulded Electrical Insulations

MADE IN

SCRANTON, PA.

BY

The Scranton Button Co.

MANUFACTURERS OF

Switch Bases, Switch Handles, Push Buttons, Socket Keys, Receiver Shells, Mouthpieces, etc.

OUR QUALIFICATIONS

Largest Plant in the World
Finest Equipment Procurable
Thirty Years' Experience

WESTERN REPRESENTATIVE

GEO. T. WESTCOTT & CO.
136 W. Lake Street
CHICAGO

Fuses Are Like Insurance

If they disappoint you it is usually too late when the fact is discovered, hence, the importance of previous investigation.

The "Union" Fuse

Is made from high-class materials, by skilled labor.

Tubing is of hard fibre and closely fits the caps.
Caps are securely attached.
Blades have rounded edges.
Indicator is positive.
Rating is accurate and reliable.

If you are not now one of the host using "UNION" fuses, why not? There is no better fuse made.

CHICAGO FUSE MFG. CO.

CHICAGO UNION TRADE MARK **NEW YORK**

AJAX AJAX

SHERWIN-WILLIAMS

AJAX

INSULATING VARNISH

(Black Elastic Baking)

It required years for us to develop a Black Elastic Baking Varnish which we were certain would meet all requirements. S-W Black Elastic Baking Varnish now possesses all the characteristics expected of such a material, and *even more.*

This Varnish remains permanently plastic against high temperatures and vibrations, is impervious to oil, is water repellent, and has high mechanical strength. The use of S-W Ajax Insulating Varnish Black Elastic Baking Varnish means satisfactory service.

Send for a copy of our Insulating Catalog

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THE SHERWIN-WILLIAMS CO.

MAKERS OF INSULATING MATERIALS

760 CANAL ROAD CLEVELAND, OHIO

USL

Meet the Demand for Isolated Electric Lighting Plants

There is a constantly growing demand for small electric lighting plants for farms, country homes, etc., in all parts of the country away from Central Station circuits. Are you getting your share of this business? If not, it will pay you to investigate.

USL Storage Battery

THE UNITED STATES LIGHT AND HEATING CO.

U-S-L Plants with U-S-L Storage Batteries are making money for dealers everywhere. These plants are easy to sell and give the best service over the greatest number of years.

Bulletin 110 Sent on Request

This is the most comprehensive catalog ever offered on Independent Electric Lighting Plants. It gives complete information on Plants of all sizes. Address our nearest Branch Office.

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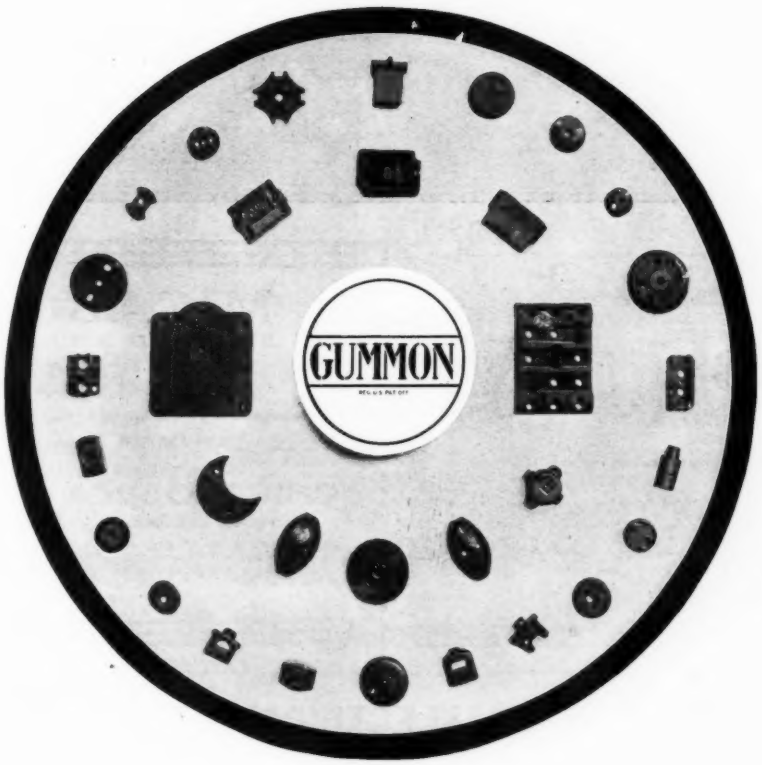
USL

The Standard
HEAT RESISTING
Moulded Insulation



Exclusively specialists in moulded insulation. You can safely trust us with your new *designs* for *estimate.* *You* also get the *benefit* of our *long* and *varied experience* and *strong basic patents.*

Hemming Manufacturing Company
Garfield, New Jersey

Electrical Supplies

of any kind furnished by us at the lowest market prices. The following list will give an idea of the material and supplies carried in stock.

Cut-outs	Motors	Switches	Globes
Portable Lamps	Luminous Radiators	Hylo Lamps	Sockets
Washing Machines	Wires	Toasters	Heating Pads
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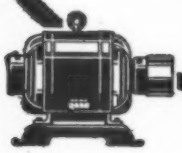
Miniature, Decorative, Tungsten and Carbon Lamps



Commonwealth Edison Company

Phone Randolph 1280 — 120 West Adams St.

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CONDUIT CONTRACTORS

GRANER-MAHONEY CONTRACTING CO.

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ELECTRIC BELLS — PR — FOR ALL USES

Always on the Square

That's the meaning of the PR *Trade Mark*

PR MFG. CO. DETROIT, MICH.

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THE STANDARD MICA INSULATION

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Of Silicon Alloy Steel, Patented. Highest grade Electrical Sheets manufactured for transformers, dynamos and motors; insuring minimum heating, maximum capacity, non-aging. Other standard sheets are American Armature, U. S. Electrical, and Pole Face. Write for full information.

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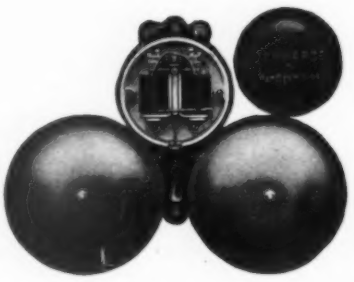

Permanent Efficiency Plus Durability

SCHWARZE ELECTRIC BELLS

We make one grade of electric bells only—the very best that can be produced for all positions where an electric bell is desired and for all conditions of service.

No. 22, Standard Bell, illustrated herewith, is for use on Battery or High Tension, Direct Current Circuits. The bell is entirely insulated from the frame; is fully approved by the Underwriters; is remarkable for its quick response and instant stopping and is (like all Schwarze Bells) absolutely guaranteed.

Write for our Catalog—it is complete in its description and illustration of our high grade line.

SCHWARZE ELECTRIC CO. — **Adrian, Mich.**

DON'T GO UP IN THE AIR!

Reference to the photograph above will show that the Matthews Easy Lamp Changer is designed as nearly like the human hand and wrist as possible. No poles furnished.

It can be bent at any angle and will quickly remove and replace lamps in high places without the aid of ladders or other dangerous means of access.

This Poor Gink Is Scared To Death

because he is afraid some one will bump into his ladder and cause him to have a nasty tumble.

The man who reads this advertisement, and still persists in letting his employees climb up into unsafe positions to change his lamps, is simply courting a lawsuit or a damage claim, or both. Keep your men on the floor and let them change your lamps with a

Matthews Easy Lamp Changer

The purchase of this little money-saver is the least expensive and best form of employer's liability insurance you can buy.

A Matthews Easy Lamp Changer can be used at any time. You can change a lamp at once instead of waiting until a dozen lamps burn out "to make it pay to go to the trouble of changing them." It only takes a couple of minutes with a Matthews and you don't bother anyone. Then the price is ridiculously low when measured by the saving it will effect. No. 1 for sign lamps, $2.50 each; No. 2 for 6 to 16 c.p. carbon and 15 to 40 watt Mazda lamps, $2.50 each; No. 3 for 32 and 50 c.p. lamps and 60 to 150 watt Mazda lamps. Postage Free if cash is sent with order. Special prices to Central Stations who want to buy in quantity and sell to their customers, who are now allowing too many dead lamps that should be bringing in revenue. Carried in stock by most Electrical Supply Dealers.

SEND IN YOUR ORDER NOW.

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THE NORTHERN ELECTRIC & MANUFACTURING COMPANY, LIMITED
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"NICHROME"
"A BOON TO THE HEATING TRADE"

A Resistance Conductor

Highly Efficient for Electrically Heated Appliances, Laboratory Furnaces and Resistance Elements Generally

Non-Corrosive, Non-Oxidizable
SPECIFIC RESISTANCE EQUAL TO MERCURY
600 Ohms per Mil. Ft. Temp. Coef. .00024 per °F.
Melting Pt. above 2800 °F.

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Manufacturers of
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Weatherproof Wires and Cables
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Show Window Cord Lamp Cord
LOWELL INSULATED WIRE CO.
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MANUFACTURERS OF
Machinery for Insulating Electrical Wires
Braiding, Taping, Winding, Twining, Cabling, Stranding, Polishing and Measuring Machines.
CABLE COVERING BRAIDERS FINE COVERING A SPECIALTY
304 Pearl Street, Providence, R. I., U. S. A.

PENN NEW CODE WIRES AND CABLES
Made in accordance with the new N. E. C. Rules taking effect January 1st, 1912. Ask for copy of specifications covering this revision.
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MANUFACTURING CO.
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New York Pittsburg Chicago

Roebling Magnet Wire
consists of specially drawn and annealed copper wire, soft and true to gauge, covered with a smooth and uniform insulation. Furnished round, flat, square and in strands.
John A. Roebling's Sons Co.
Trenton, N. J.

For Thirteen Years

"American Brand"

Weather-Proof Wire and Cables

have shown uniform excellence

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American Insulated Wire & Cable Co.

21st, Sangamon and Morgan Sts.

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AND YOU ARE CERTAIN OF OBTAINING

THE CABLE WITH WELL GALVANIZED FLEXIBLE STEEL ARMOR

NEW CODE INSULATION AND DISTINGUISHABLE BRAIDS

THE CABLE THAT 14 YEARS' OF UNQUALIFIED SUCCESS

HAVE PROVED TO GIVE

MAXIMUM SERVICE VALUE

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Every foot is carefully inspected by us in the various stages of manufacture and when completed is finally examined and labeled under the direction of the Underwriters' Laboratories.

We are prepared to furnish this wire in all sizes and conductors, both solid and flexible, from warehouses conveniently located for quick delivery to all parts of the country.

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Export Representative: U. S. Steel Products Co., New York. Pacific Coast Representative: U. S. Steel Products Co., San Francisco, Los Angeles, Portland, Seattle.

The Greatest Advance in the Solution of the Lighting Problem

since the invention of the carbon lamp about 20 years ago, has been made by the

INDEPENDENT Ductile Drawn Wire **Tungsten Lamp**

It has greater utility than the carbon lamp.

If the filament is broken, it will frequently fuse again, if the globe be gently tapped and will burn as before, while a broken carbon filament ends the usefulness of the lamp.

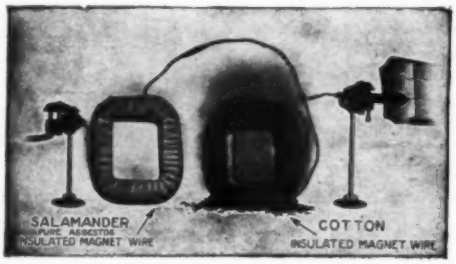
It gives a white light, resembling daylight more closely than anything yet produced by human ingenuity.

There is no deterioration in quality of light, whereas the carbon lamp gives a weaker and yellower light the longer it burns.

It effects a saving of 75 per cent in current for the same candlepower.

Field and Armature Coils Subjected to Heavy Overloads Made Permanently Fire-Proof with SALAMANDER

Pure Asbestos Insulated Magnet Wire



Showing the result of heat on cotton-insulated coil, and its non-effect on Salamander asbestos-insulated coil.

Write for booklet. Yours for the asking.

Make your machinery that is subjected to heavy overloads or high temperatures safe at all times with Salamander Fireproof Wire. Constructed of the indestructible asbestos—it gives the greatest protection at the smallest cost at all times. Indestructible equipment is a necessity—Salamander Fireproof Wire makes yours a reality, is approved and used by the United States Government and in many of the largest Central Stations in the country.

Independent Lamp and Wire Co., 1733 Broadway, New York
Works: York, Pa., and Weehawken, N. J.

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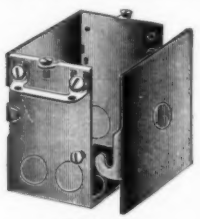

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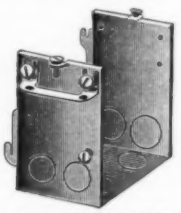
Showing Removable Side



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500 rooms with private bath. European plan $2.00 per day and up. One block from new Pennsylvania R. R. Station.
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Know them by their extra heavy caps and tubing; by the four screws in each cap; by their soldered blades and perfect alignment; by the full rating on labels and ampere capacity stamped in fibre; by the safe indicator and absence of exposed metal.

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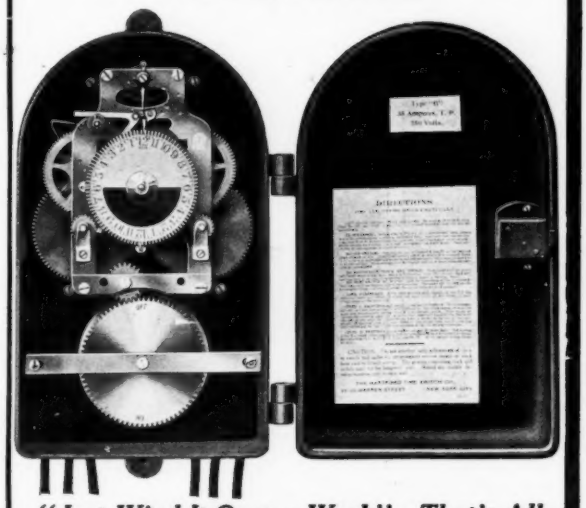

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Standard types in all capacities for every condition of service.

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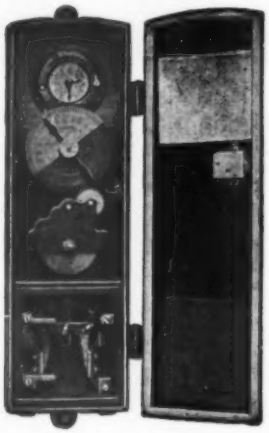

Type F Time Switch

Double Pole, Single Throw for 250 Volts D. C. or A. C.

Operating Mechanism is positive and absolutely dependable under all conditions. Will switch circuits on or off at any predetermined time. No attention other than winding once a week is necessary. This time switch may be equipped with Sunday or Holiday Cut-Out Attachment, or Saturday Time Extension Device.

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indicate the character of the store. The windows must be well lighted. The lights should be automatically controlled. Get after the merchants now. Show them what

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Bulletin 30 describes types to cover any desired combination.

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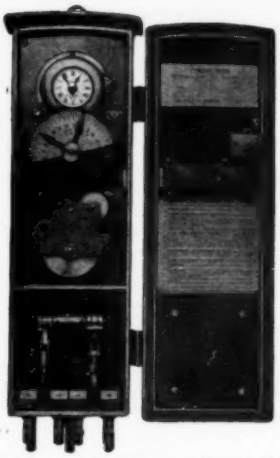

Type K Time Switch

Double Pole, Double Branch, for Potentials not Exceeding 250 Volts, A. C. or D. C.

This switch is designed to close one circuit before the other and open both at the same time, or to close both circuits at the same time and open at different times.

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The Viking Electric Company, Inc.

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Result:

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We have trained men for this class of tests and can undertake them at short notice.
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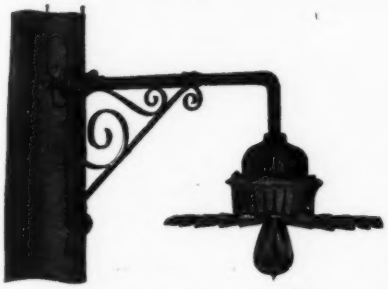

No. 5030. A good-looking inner-wired telescope street fixture with porcelain insulating casing.

No. 1386. Rope suspension type swinging fixture with porcelain enameled reflector. This fixture can also be provided with span suspension clamp.

Always Up-to-Date

Kyle Line streethoods and tungsten fixtures are not relics of twenty years ago. They are made according to today's requirements. Improvements and changes are continually being made so that you get the most up-to-date fixtures when you buy

The Kyle Line
Street Lighting Fixtures

Our latest line—the 5,000 Line—has many strong features. The insulating casing is made of one husky chunk of porcelain. This makes the fixture suitable for use on either series or multiple circuits without requiring an additional insulator.

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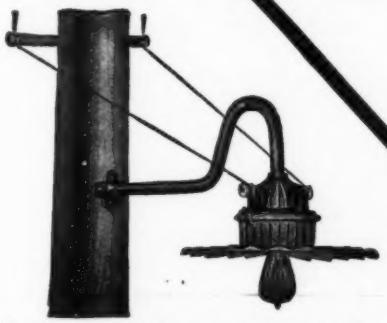
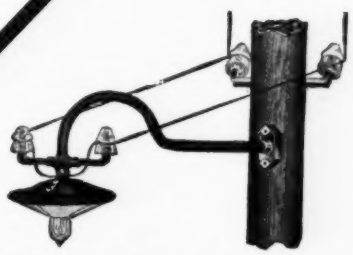
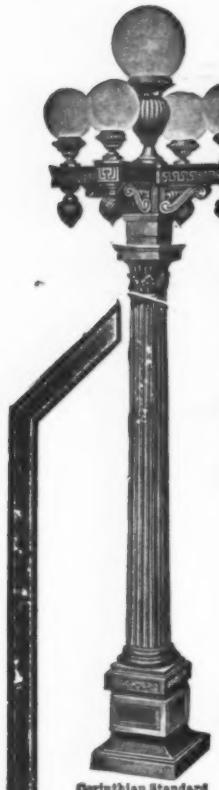


No. 5002—One of the new 5000 line. Big insulating casing and porcelain enameled reflector.



No. 1250—Steel channel insulator arms, petticoat insulator, triple coated and baked, durable japanned reflector.



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Generations hence, the unimpaired classic beauty of

Corinthian Standards

will prove the wisdom of buying the best.

Designed, cast and finished by

Flour City Ornamental Iron Works

Minneapolis, Minn.

WESTERN ELECTRIC CO., Selling Agents
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KING DE LUX NO 105

Do you know of the advantage to be found in the use of

King

Unit or Sectional

Standard

The King method is a flexible one, that is, you can install a one-light standard as a starter and as the demand for more illumination increases, you can satisfy it by adding additional lights as needed. The expense is small; your customers will appreciate this item.

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Meyers Ornamental Standards

will materially help in closing that stubborn contract. Cities in two continents have been beautified by Meyers installations and the U. S. Government is a large user of both our Cast Iron and Bronze Standards and Brackets.

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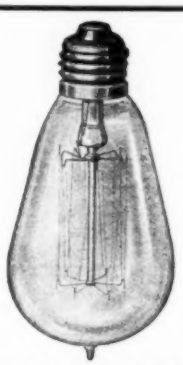

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Are you receiving lamps of the *highest quality*, at the *lowest price?* If not, advise us of your requirements and let *us* quote you on same. We are an **Independent Company,** of long standing, and can supply you with a **Guaranteed** Class "A" **Carbon** or **Wire Drawn Tungsten** lamp at a great saving to you.

As we carry a large stock of lamps of every description, we can make prompt deliveries at all times.

Allow us to ship you a case of whatever class lamp you need, on **Thirty Days' Approval,** to prove our statements to you?

Saving in Price. Highest Quality. Ironclad Guarantee.

NEW YORK INCANDESCENT LAMP CO.

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No Afternoon "Change of Pace"

in the efficiency factor of industrial plants where daylight is supplanted by

BENJAMIN
Specialized Commercial Lighting

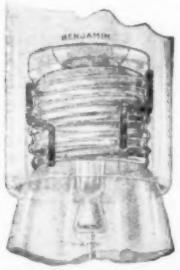
When daylight wanes, Benjamin Reflectors take over Old Sol's task, and quality and speed of production remain unaltered. This "continued daylight" is not obtained at an increased expenditure of energy consumption, but rather from the conservative use of scientifically designed reflectors and the proper positioning of the lighting units.

Compare the two views above—one showing the shop lighted by 360 sq. ft. of window area, the other a 10-minute **unretouched** exposure under the light from Benjamin Reflector Units. **The result is obtained at an energy consumption of but .94 watts per square foot.**

Besides Current Consumption Economy

Benjamin Specialized Industrial Units distribute 30% more useful light where they replace arc lamps. The cost of trimming and daily attention is eliminated, for all the fixtures require is dusting once a month. Interchanging of lamps on direct and alternating circuits is made possible, and strong, steady, non-flickering light is obtained. Naturally this uniformly distributed light is productive of all the indirect benefits of correct illumination—more and better work, a decrease in spoilage, etc., collectively a greater return than the direct saving of current costs.

Prevents Danger and Loss of Falling Lamps



There need be no more falling lamps in any factory—due to vibration, jars or wind. A falling lamp means chance of injury to workmen—the loss of the lamp is, in itself, waste. Benjamin Lamp Grips hold the lamp base tightly—a simple spring does the trick. Look into this little device.

Features of Benjamin Construction

The above installation shows *one* of the Benjamin line of fixtures peculiarly adapted to industrial lighting. It is known as the "Adjustolite," because the reflector can be adjusted to cover three sizes of lamps, by merely loosening two screws and sliding reflector to one of three positions indicated (3 sizes, 7, 9 and 11 inch, cover a range of 25 to 250 watts). It is furnished with lamp grip, as described in panel, another feature not found on other installations that adds greatly to the furtherance of factory lighting economy.

Write for our new No. 11 Industrial Lighting Bulletin. It shows how we make good, and our list of large users is the best evidence of "results." Just fill out the coupon or write the

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120-128 S. Sangamon Street, Chicago, Ill.

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Please send me full information on your lighting fixtures and a description of what you have already done for other concerns.

Name .....

Address .....

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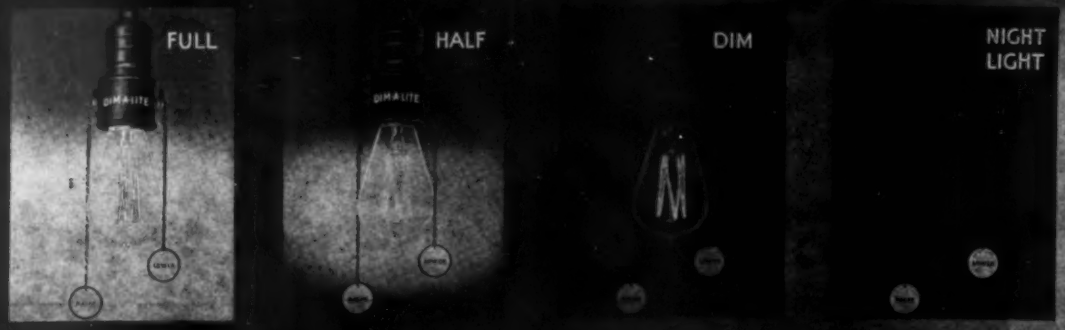

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Makes Electric Light as easily controlled as Gas

Sell one or more Dim-a-Lites to every household

They "sell on sight"—and at a good profit. Solidly built—Used three years without a sign of trouble. Easily attached. Fire and fool-proof. Approved by Underwriters' Laboratories. Send for a sample—$1.00 prepaid. Liberal discounts to dealers.

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Columbia Solid Homogeneous Flame Carbons are now shipped in colored cartons so that either the white or yellow carbon can quickly be distinguished.

These cartons pack easily, are convenient to handle, and prevent breakage and mixing of sizes.

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STONEHENGE DESIGN

A new pressed opal.

A new reflector design.

Good illumination efficiency, excellent appearance, wide adaptability, and the right price.

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That's exactly what handling the

GILL PATENTED TUNGSTEN REFLECTORS

will mean to you—they are so brilliantly beautiful that they don't stay long in the store—("duplicate my order for the ***easy selling*** Crystal Reflectors" writes one dealer). Do you want to be prepared to furnish the best reflectors on the market?

Write now and get our liberal proposition

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An Absolutely Glareless Semi-Indirect Light

Simple, Economical, Dust-Proof, Efficient

Try It for Better Illumination

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A Christmas Trade Getter

Handsome Portable Reading Lamps make attractive Christmas Gifts, and bring profitable sales to the electrical dealer.

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illustrates a new line of Portables, distinctive in design, and priced right to bring you big results.

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CRESCENT COLORING FLUID

It offers the easy and inexpensive method of imitating real colored glass. Will not peel or crack if used according to directions.

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An Easy Replacement of the Wearing parts are Features of the

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No Sliding Contacts

This is an important feature as everyone knows that sliding contacts require a great deal of attention and, as a rule, cause trouble due to arcing and consequent sticking of the moving member.

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"THE ELECTRIC LAMP WICK"

CONVENIENT — DURABLE

A wonderful invention for the perfect control of current in incandescent lamps of any make.

Turn your light up or down the same as a kerosene lamp. Saves 80% of the current. Indispensable for the sick room, night light, bath room, halls, etc.

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50 amp.	250 volt	
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Flush Wall Pockets and Plugs, Auto Charging Pockets and Plugs. Water-proof Pockets and Plugs, Portable Stage Pockets and Plugs.

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Investigate This Exceptional Lamp Specially Designed for the Lighting of Factories and Large Areas

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INTENSE FLAMING ARC THE REAL LAMP

These real lamps are distinguished by long burning hours, no carbon waste, no complications, low initial and low maintenance costs. Perfect light distribution and entire freedom from flickering.

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Almost any flaming arc makes good with "Excello" Carbons.

Let us furnish prices on homogeneous long-burning Flaming Carbons.

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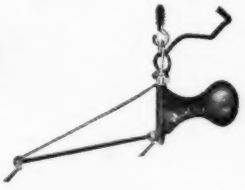

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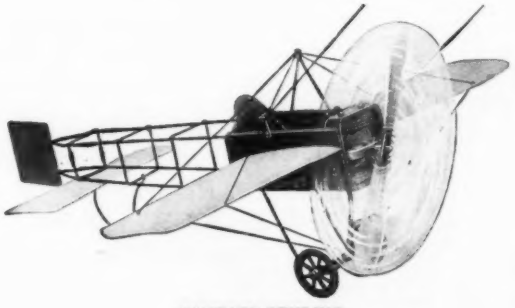

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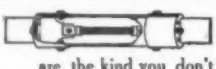

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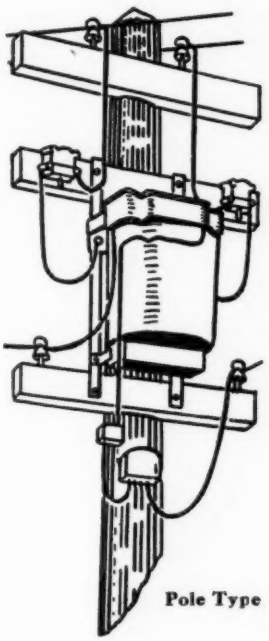

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A-W Mazda Regulators furnish ideal control on *mixed circuits*—in cities where arc lamps are used and it is desired to extend the system and install series tungsten lamps on the same circuit.

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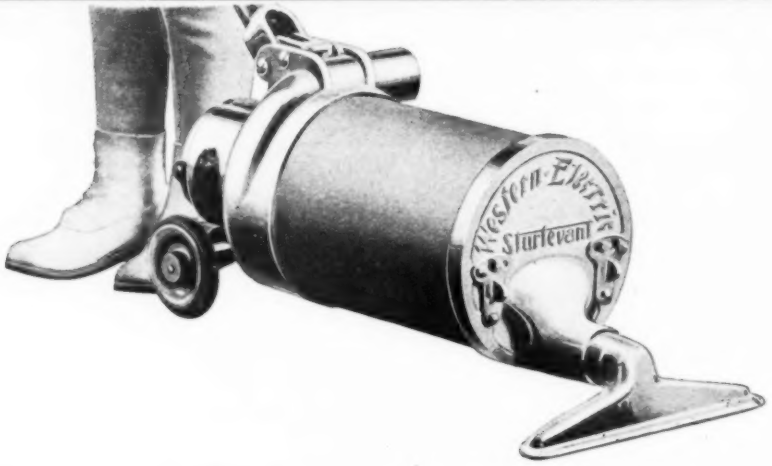

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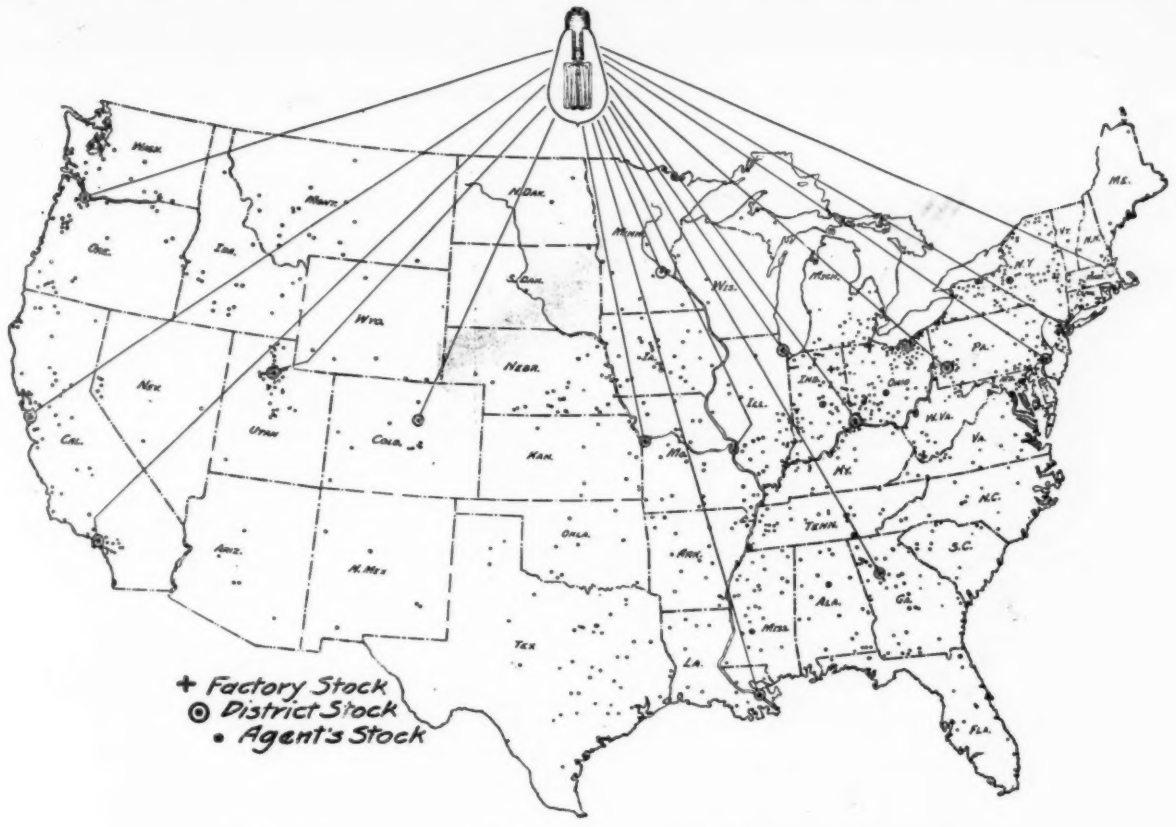

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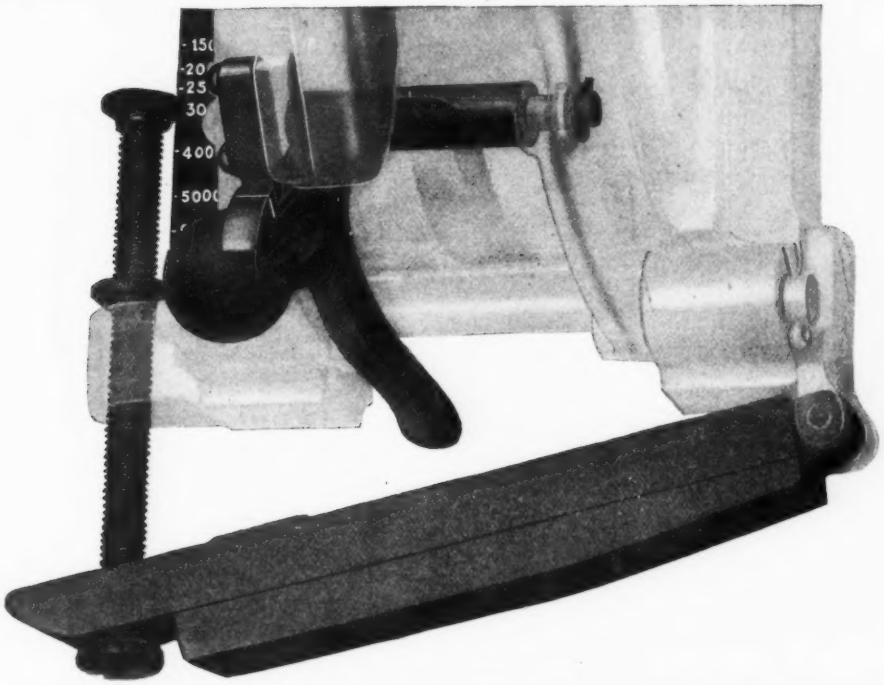

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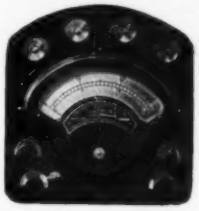

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Stanley & Patterson, New York. "Premier".
Western Electric Co., New York. "Hawthorn".
Ansonia Electrical Co., Ansonia, Conn.
Automatic Appliance Co., Boston, Mass.
Connecticut Telephone & Elec. Co., Meriden, Conn.
De Veau Telephone Mfg. Co., Brooklyn, N. Y. "Auth."
Edwards & Co., New York. "Eco", "Cadet", "Dixie", "Shallow Type".
Electric Goods Mfg. Co., Canton, Mass. "Rival", "Hub", "Ross", "Dandy", "Perfect", "Nexall".
Garl Electric Co., Akron, Ohio.
Holtzer-Cabot Electric Co., Brookline, Mass.
Francis Keil & Son, New York.
Knickerbocker Annunciator Co., New York.
Moon Mfg. Co., Chicago, Ill. "Eclipse", "Acme", "Knapp".
National Electric Works, Whittier, Cal. "Incitophone".
Partrick, Carter & Wilkins Co., Philadelphia, Pa. "King", "Guarantee", "Competition".

ANNUNCIATOR WIRE. See Wire, Rubber Covered.

ARRESTERS, Lightning. See Lightning Arresters.

ASBESTOS, Sheet, Paper, Millboard, Lumber.
General Bakelite Co., New York. (Asbestos Paper.)
H. W. Johns-Manville Co., New York, N. Y.
Philip Carey Mfg. Co., Cincinnati, Ohio.
Ehret Magnesia Mfg. Co., Philadelphia, Pa.
Franklin Mfg. Co., Franklin, Pa.
R. M. Gilmour Mfg. Co., New York.
Keasbey & Mattison Co., Ambler, Pa.
New Jersey Asbestos Co., Camden, N. J. "Gladiator".
N. Y. Asbestos Mfg. Co., New York.
Norristown Magnesia & Asbestos Co., Norristown, Pa.
H. F. Watson Co., Erie, Pa.

ATTACHMENT PLUGS.
Arrow Electric Co., Hartford, Conn.
Benjamin Electric Mfg. Co., Chicago, Ill.
Central Electric Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady.
Manhattan Electrical Supply Co., New York. "Meseo".
H. T. Paiste Co., Philadelphia.
Pass & Seymour, Inc., Solvay, N. Y.
Simplex Electric Heating Co., Cambridge, Mass. (For heating devices).
Trumbull Electric Mfg. Co., Plainville, Conn.
Union Electric Co., Trenton, N. J.
Bryant Electric Co., Bridgeport, Conn.
E. H. Freeman Electric Co., Trenton, N. J.
Harvey Hubbell, Inc., Bridgeport, Conn.
C. S. Knowles, Boston, Mass.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Peru Electric Co., Peru, Ind.
Tregoning Electric Mfg. Co., Cleveland, Ohio.

ATTACHMENTS, Gas Fixture.
Trumbull Electric Mfg. Co., Plainville, Conn.
American Brass & Copper Co., New York.
Bryant Electric Co., Bridgeport, Conn.
Plume & Atwood Mfg. Co., Waterbury, Conn.
I. S. Spencer's Sons, Guilford, Conn.
Steele & Johnson Mfg. Co., Waterbury, Conn.
J. H. White Mfg. Co., Brooklyn.

ATTACHMENTS, Socket Chain Adjusters, Chain Extensions, Socket Pulls.
Any Lite Incandescent Lamp Regulator Co., North Yakima, Wash. (Regulating Attachment).
Pheins Mfg. Co., Detroit, Mich.
A. E. Rittenhouse Co., Honeoye Falls, N. Y.
Economy Electric Specialty Co., Charlestown, Mass.
Harding Electric Co., Brooklyn, N. Y. (Socket Chain Extension).
Harvey Hubbell, Inc., Bridgeport, Conn.

AUGERS. See Tools, Digging.

AUTO STARTERS (For starting A. C. Motors).
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady.
Independent Electric Mfg. Co., Milwaukee, Wis.
Triumph Electric Co., Cincinnati, Ohio.
Wagner Electric Mfg. Co., St. Louis.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Western Electric Co., New York.

AUTOMOBILES, Electric.
S. R. Bailey & Co., Amesbury, Mass.
General Vehicle Co., Long Island City, N. Y. (Commercial Vehicles).
Anderson Electric Car Co., Detroit, Mich. "Detroit-Electric."
Atlantic Vehicle Co., New York, N. Y.
Automobile Maintenance & Mfg. Co., Chicago, Ill. (Commercial Vehicles).
Babcock Electric Vehicle Co., Buffalo, N. Y.
Baker Motor Vehicle Co., Cleveland, Ohio.
Borland-Grannis Co., Chicago.
Broc Elec. Vehicle Co., Cleveland, Ohio.
Champion Wagon Co., Owego, N. Y. (Commercial Vehicles).
Chase Motor Truck Co., Syracuse, N. Y. (Repair Wagons).
Columbia Motor Car Co., Hartford, Conn.
Columbus Buggy Co., Columbus, Ohio.
Commercial Truck Co. of America, Philadelphia, Pa.
Couple-Gear Freight Wheel Co., Grand Rapids, Mich. (Gas Electric).
Fritchle Automobile & Battery Co., Denver, Colo.
Hupp-Yeats Electric Car Co., Detroit, Mich.

International Motor Co., New York.
Lansden Co., Newark, N. J. (Commercial Vehicles).
Minneapolis Electric Motor Co., Minneapolis, Minn.
Ohio Electric Car Co., Toledo, Ohio.
Phipps Grinnell Auto Co., Detroit, Mich.
Ranier Motor Truck Co., New York, N. Y. (Commercial Vehicles).
Rauch & Lang Carriage Co., Cleveland, Ohio.
Studebaker Automobile Co., South Bend, Ind.
Toledo Electric Vehicle Co., Toledo, Ohio.
Ward Motor Vehicle Co., New York.
Waverley Co., Indianapolis, Ind.
Woods Motor Vehicle Co., Chicago, Ill.

AUTOMOBILE LIGHTING SYSTEMS.
General Electric Co., Schenectady, N. Y.
Wagner Elec. Mfg. Co., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Willard Storage Battery Co., Cleveland, Ohio. ("Elba" System).
Apple Electric Co., Dayton, Ohio.
Dyneto Electric Co., Elbridge, N. Y.
Electric Auto-Lite Co., South Bend, Ind. "Fisher."
The Esterline Co., Lafayette, Ind.
Hartman Electrical Mfg. Co., Mansfield, Ohio.
Holtzer-Cabot Electric Co., Brookline, Mass.
North East Electric Co., Rochester, N. Y.
Standard Electric Novelty Co., Chicago, Ill. (Motor Cycle Headlight).
Stuart-Howland Co., Boston, Mass.
Vivax Storage Battery Co., Chicago, Ill.
Ward Leonard Electric Co., Bronxville, N. Y.

BAGS AND BELTS, Linemen's. See Tools, Linemen's.

BAKERS' AND CONFECTIONERS' APPARATUS, Motor Driven.
General Electric Co., Schenectady, N. Y. (Corn Poppers).
Triumph Electric Co., Cincinnati, Ohio. (Bakers' Machinery).
Alsop Process Co., St. Louis, Mo. (Flour Bleaching Apparatus).
Barnhart Mercantile Co., St. Louis, Mo. (Nut Crackers).
Champion Machinery Co., Joliet, Ill. (Bakers' Machinery).
Confectioners' Machinery & Mfg. Co., Springfield Mass. (Chocolate and Candy Machinery).
Consolidated Wrapping Machinery Co., Springfield Mass. ("Knott" Candy Wrapping Machines).
J. H. Day Co., Cincinnati, Ohio.
A. J. Deer Co., Hornell, N. Y. ("Royal" Coffee Roasters).
Hugo Gottschalk & Co., Burnham, Pa. (Pan Cleaning and Greasing Machines).
Hall Kitchen King Mfg. Co., Philadelphia, Pa. (Machine for beating eggs, whipping cream, washing potatoes, straining soups, etc.).
H. L. Hildreth Co., Boston, Mass. (Candy Pulling Machines).
Huntley Mfg. Co., Silver Creek, N. Y. ("Monitor" Coffee Roasters).
Indianapolis Candy Co., Indianapolis, Ind. (Candy Mixers).
Read Machinery Co., York, Pa. (Dough Mixers).
Shaffer Candy Machine Co., New York. (Candy Machinery).
Turnbull Mfg. Co., Columbus, Ohio. (Corn Poppers, Pop Corn Ball and Fritter Machines).
J. E. L. Wharton, Philadelphia, Pa. (Ice Breakers).
Wolf Co., Chambersburg, Pa. (Dough Mixers and Flour Blenders.)

BANDS, Pipe.
American Bridge Co., New York.

BARS, Commutator (Bus Bars and Commutator Bars).
Electrical Engineers' Equipment Co., Chicago.
Billings & Spencer Co., Hartford, Conn.
Cameron Electrical Mfg. Co., Ansonia, Conn.
Columbia Machine Works & Malleable Iron Co., Brooklyn, N. Y.
Commutator Co., Minneapolis, Minn.
Eureka Tempered Copper Works, North East, Pa.
Forest City Electric Co., Cleveland, Ohio.
Homer Commutator Co., Cleveland, Ohio.
Mansfield Tempered Copper Co., Mansfield, Ohio.
Philadelphia Electric Mfg. Co., Philadelphia.
A. L. Prentiss & Co., Buffalo, N. Y. (Pneumatic Combination Base and Retriever).
Rome Brass & Copper Co., Rome, N. Y.

BASES AND SUB-BASES. Snap Switch.
Arrow Electric Co., Hartford, Conn.
Pass & Seymour, Inc., Solvay, N. Y.
Wm. H. Colgan Co., West Newton, Mass. "Rex".
Newton Hublinger, Akron, Ohio.
Kinsey Mfg. Co., Toledo, Ohio.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Tirrill Mfg. Co., Athens, Pa.
Weber Electric Co., Schenectady.

BATTERIES. Dry.
Burnley Battery & Mfg. Co., North East, Pa.
Central Electric Co., Chicago, Ill.
Johns-Manville Co., H. W., New York. "J-M".
Manhattan Electrical Supply Co., New York. "Hi-Up", "Red Seal", "Blue Seal", "Mesco".
National Carbon Co., Cleveland, Ohio. Intermittent service—"Atlantic", "Columbia", "Eastern", "Globe", "Hercules", "Solar", "Standby", "U. S. Standard". Ignition — "Autocell", "Columbia Ignitor", "Columbia Multiple", "Multiplex", "Standby Auto", "U. S. Ignitor". Earphones—every type. Flashlights—"Columbia", "Blue Label", "Mazda".
Nungesser Carbon & Battery Co., Cleveland, Ohio. "Acme Rapid Fire", "1900".
Stanley & Patterson, New York. "Patterson" Wireless Dry Battery System, "Matchless" Battery Cells for Flashlights.
Western Electric Co., New York. "Crowfoot", "Flashlight", "Leclanche", "Blue Bell".
American Carbon & Battery Co., St. Louis, Mo.
American Ever Ready Co., New York. "Ever Ready".
Argus Battery Co., Willimantic, Conn. "Odin".
Bright Star Battery Co., New York.
J. H. Bunnell & Co., New York. "Mascot", "Jove", "Standard".
Burn-Boston Battery & Mfg. Works, Boston, Mass. "Burn-Boston", "Noloss".
Edward E. Cary, New York. "Green Seal".
Chicago Carbon Co., Chicago, Ill. "Jewell" (Add Water).
Chloride of Silver Dry Cell Battery Co., Baltimore, Md.
E. S. Cowle Electric Co., Inc., Kansas City, Mo.
Emciency Electric Co., Chicago.
Electric Mfg. Co., St. Paul, Minn. "Enco" (Sealed).
Electric Goods Mfg. Co., Canton, Mass. "Sampson Semi-Dry".
Englewood Carbon Works, Chicago, Ill. "Black Cat", "XCell".
Franco American Electric Novelty Co., New York. "Novelty".
French Battery & Carbon Co., Madison, Wis. "Fleur De Lis".
Lincoln Electric Co., New York. "Hi-Po".
Lutz-Lockwood Mfg. Co., Roselle, N. J. "Aldene", "SX".
Mills Electric Co., Peoria, Ill. "Local Option".
Wm. Roche, Jersey City, N. J.
Rock Island Battery Co., Cincinnati, Ohio.
Secret Service Dry Battery Co., Everett, Mass. "Secret Service" (For Flashlights only).
Semi-Dry Battery Co., New York. "Dunn".
Stackpole Carbon Co., St. Marys, Pa. "Sun", "Wizard", "X-Ray", "Hello", "Autocrat".
Standard Electric Novelty Co., Chicago, Ill. (Flashlight).
U. S. Auto Battery Co., New York. "Readyspark", "Topnotch".
Voltamp Elec. Mfg. Co., Baltimore, Md.
Westchester Appliance Co., New York.
White Star Battery Co., New York. "White Star", "Red Star".
H. Wilhelm, Brooklyn, N. Y.

BATTERIES, Medical.
Manhattan Electrical Supply Co., New York. "Apollo", "Anti-Doc", "Household", "Home".
Menominee Elec. Mfg. Co., Menominee, Mich.
National Carbon Co., Cleveland.
W. R. Ostrander & Co., New York. "Criterion".
Stanley & Patterson, New York. "Vetter", "Davis & Kidder", "Electrotonic".
J. H. Bunnell & Co., New York. "Auto-Kure", "Home".
Detroit Medical Battery Co., Detroit, Mich.
Electric Therapeutic Mfg. Co., Indianapolis, Ind.
Matthew Engeln Electric Co., Chicago, Ill.
W. F. Ford & Co., New York.
Kendrick & Davis Co., Lebanon, N. H.
D. P. McElliott, Chicago, Ill.
McIntosh Battery & Optical Co., Chicago, Ill.
Wm. Meyer Co., Chicago, Ill.
Meyrowitz Mfg. Co., New York, N. Y. "Vetter".
Oliver Electric Co., Philadelphia, Pa. "Electro-Rol".
Patrick, Carter & Wilkins Co., Philadelphia, Pa.
Pierson-Wilcox Electric Co., Minneapolis, Minn.
Leon W. Pullen Co., Philadelphia, Pa. "Gal-Far".
L. Sence & Son, New York.
Storage Battery Supply Co., New York. "Reliance".
Van Houten & Ten Broeck, New York.
Voltamp Electric Mfg. Co., Baltimore, Md.
Waite & Bartlett Mfg. Co., New York.
Wappler Elec. Mfg. Co., New York, N. Y.
Wallman Mfg. Co., Jersey City, N. J.

BATTERIES, Storage.
Edison Storage Battery Co., Orange, N. J.
Electric Storage Battery Co., Philadelphia, Pa. "Stand-By", "Exide", "Hycap-Exide", "Tabor", "Chloride".
Gould Storage Battery Co., New York.
United States Light & Heating Co., New York. "National", "Unit".
Willard Storage Battery Co., Cleveland, Ohio. "Elba".
Ajax Battery Co., Chicago, Ill.
American Storage Battery Co., Cambridge, Mass. "Harvard".
Apple Electric Co., Dayton, Ohio. "Sixty-Six".
J. F. Ashbrook, Chicago, Ill. "Squired".
Auto Battery & Elec'l Co., Buffalo, N. Y.
Avery Portable Lighting Co., Milwaukee, Wis. ("Electrobola" Automobile Lighting).
The Battery Co., Milwaukee, Wis.
Bison Storage Battery Co., Buffalo, N. Y.
Edward E. Cary Co., New York. "The Dollar".
Commercial Battery Co., Chicago, Ill. "Combat".
Geissler Bros. Storage Battery Co., New York. "Midget".
Heissler Storage Battery Co., Chicago, Ill.
Helios Mfg. Co., Philadelphia, Pa.
Hoosier Storage Battery Co., Evansville, Ind. "Hobo", "Fire-Fly".
Jewell Electric Co., Chicago, Ill. "U-Auto".
Knop Battery Co., Detroit, Mich. "Wizard".
Kuehn & Metz, New York, N. Y.
Lemke Electric Co., Milwaukee, Wis. "L-B".
Hector C. MacRae, Baltimore, Md. "Champion".
Miller Storage Battery Co., Toledo, Ohio.
Milwaukee Auto Specialty Co., Milwaukee Wis. "Victor", "Masco", "Rodiuna".
Mound City Battery Co., St. Louis, Mo.
Multiple Engineering Co., New York.
Northwestern Storage Battery Co., Milwaukee, Wis.
Philadelphia Storage Battery Co., Philadelphia, Pa. "Diamond Grid".
Schug Electric Mfg. Co., Detroit, Mich.
Silvey Electric Co., Dayton, Ohio.
Storage Battery Supply Co., New York.
Tray Plate Battery Co., Binghamton, N. Y.
Vesta Accumulator Co., Chicago.
Vivax Storage Battery Co., Chicago, Ill. "Duro".
Winter Battery Co., Chicago, Ill.
Witherbee Igniter Co., Springfield, Mass.
Zoar Battery Co., Zoar, Ohio.

BATTERIES, Wet, Closed Circuit, Open Circuit.
Central Electric Co., Chicago, Ill.
Leclanche Battery Co., New York. "Gonda", "Tex."
Manhattan Electrical Supply Co., New York.
National Carbon Co., Cleveland, Ohio. Open Circuit — "Leclanche", "National No. 2", "National No. 7", "National Fuller", National Gravity, "National Klondike", "Standard Fuller", "Trojan". Closed Circuit — "Columbia Track", "Columbia Signal".
American Carbon & Battery Co., St. Louis, Mo. "Phoenix".
The Battery Co., Milwaukee, Wis. "Gugler".
Banks Elec. & Mfg. Co., New York. (Closed Circuit).
Edison Mfg. Co., Orange, N. J. "BSCO", Closed Circuit.
Electric Goods Mfg. Co., Canton, Mass. "Hub", "Samson", "Nosmas".
Enterprise Electric Supply Co., Latrobe, Pa. "Franklin".
Jonas Battery Co., Toledo, Ohio.
Lutz-Lockwood Mfg. Co., Roselle, N. J. ("Gordon" Closed Circuit).
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Leon W. Pullen Co., Philadelphia, Pa.
Waterbury Battery Co., Waterbury, Conn. "Excelsior", "Schoenmehl", "Victor" Closed Circuit.
S. S. White Dental Mfg. Co., Philadelphia, Pa. "Partz".

BATTERY BOXES.
L. S. Brach Supply Co., New York, N. Y.
Eureka Supply Co., Sewell, N. J. (Moulded fibre battery boxes).

BATTERY HOLDERS.
National Carbon Co., Cleveland, Ohio.
Stanley & Patterson, New York. "Sealed-in", "Watertight" Wireless.
A. S. Campbell Co., Boston, Mass. "Cello".
Eureka Supply Co., Sewell, N. J. (Fibre).
E. W. Magna Mfg. Co., Holyoke, Mass.
Mersman Bros., Ottawa, Ohio. (Cabinet).
Paragon Sellers Co., Chicago, Ill.
Regal Telephone & Mfg. Co., Saginaw, Mich. "Milwaukee".
Sumter Tel. Mfg. Co., Sumter, S. C. "Mason".

BEARING METALS.
Magnolia Metal Co., New York.
Phosphor-Bronze Smelting Co., Philadelphia, Pa.

BEARINGS, Ball.
American Ball Bearing Co., Cleveland, Ohio.
Hess-Bright Mfg. Co., Philadelphia, Pa.

BELL RINGING MOTORS.
Western Electric Co., New York.
Butler Electric Co., David City, Neb.
Holtzer-Cabot Electric Co., Brookline, Mass.
Roth Bros. & Co., Chicago.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.

BELL RINGING TRANSFORMERS. (See Transformers, low voltage).

BELLS, Cable End. See Petheads.

BELLS, Electric.
Central Electric Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York. "Imperial", "Monarch", "Peerless", "Nonpareil", "Monitor", "Utility", "Crescent", "Crescendo".
Menominee Elec. Mfg. Co., Menominee, Mich.
P. R. Mfg. Co., Detroit, Mich. "Eclipse", "XXX", "Mario", "Weather-proof", "Ekla", "Straight Line".
Schwarze Electric Co., Adrian, Mich.
Stanley & Patterson, New York. "Competition", "Globe", "Faraday", "Liberty", "Columbia".
Western Electric Co., New York. "Hawthorn", "Faraday".
W. R. Ostrander & Co., New York.
Allen Ditson, Galena, Kan.
Ansonia Electrical Co., Ansonia, Conn. "Wizard", "Acme", "Eureka".
J. H. Bunnell & Co., New York, "Beko".
Darche Mfg. Co., Chicago, Ill. "Howdy Do".
Edwards & Co., New York. "Vigilant," "Auto-Recti," "Cadet," "Lungen," "Eco".
Electric Goods Mfg. Co., Canton, Mass. "Dandy", "Tyrolean", "Victor".
Francis Keil & Son, New York. "Ampro", "Reliance".

Holtzer-Cabot Electric Co., Brookline, Mass. "Hub", "Dome", "Berlin".
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Spies Electric Co., Chicago, Ill. "Segardahl".

BELLS, Extension. See Magnetos.

BELT DRESSINGS.

Joseph Dixon Crucible Co., Jersey City, N. J.

BELT FASTENERS.

Bristol Co., Waterbury, Conn.
P. Wall Mfg. Supply Co., Pittsburgh, Pa.

BELTING.

B. F. Goodrich Co., Akron, Ohio. (Rubber Belting.)
American Laminated Belting Co., New York.
Charles Bond Co., Philadelphia.
Chicago Rawhide Mfg. Co., Chicago.
Morse Chain Co., Ithaca, N. Y.
Peerless V-Belt Co., Chicago. (Chain Drives.)
J. E. Rhoads & Sons, Wilmington, Del.
Chas. A. Schieren Co., New York.
"Duxbak" Waterproof Leather Belting.
Shultz Belting Co., St. Louis, Mo.

BENDERS, Conduit and Pipe.

A. E. Rittenhouse Co., Honeoye Falls, N. Y.
Steel City Electric Co., Pittsburg, Pa. "Fullman".
Thomas & Betts Co., New York. "Lakin". "Standard".
Western Electric Co., New York.
R. C. Bierdemann & Co., Chicago, Ill. "Star".
Chicago Pneumatic Tool Co., Chicago, Ill. "Little Giant".
J. Filmore Cox & Co., Bayonne, N. J. (Power driven.)
Glaze-Morris Mfg. Co., Columbus, Ohio. "Jem"
H. C. Roberts **Electrical Supply** Co., Philadelphia, Pa. "Victor".
Tube Bending Machine Co., Newark, N. J.
Vanderman Mfg. Co., Willimantic, Conn.
Thos. Wrigley Co., Chicago, Ill.

BINDING POSTS.

Bridgeport Brass Co., Bridgeport, Conn.
Manhattan Electrical Supply Co., New York.
Menominee Electric Mfg. Co., Menominee, Mich.
Ostrander & Co., W. B., New York, N. Y.
Stanley & Patterson, New York.
Western Electric Co., New York.
American Pin Co., Waterbury, Conn.
Barnes Co., Wallace, Bristol, Conn.
J. H. Bunnell & Co., New York.
Fahnestock Elec. Co., Brooklyn, N. Y. (Spring.)
Foote, Pierson & Co., New York.
Hartford Machine Screw Co., Hartford, Conn.
International Brass & Electric Co., New York.
National Acme Mfg. Co., Cleveland, Ohio.
Royal Electric Co., Milford, Ind. (Spring.)
United Metal Mfg. Co., New York, N. Y.
Victor Electric Co., Chicago, Ill.
Waterbury Mfg. Co., Waterbury, Conn.
Welch & Co., T. F., Boston, Mass.

BITS. See Drills.

BLOCKS, Fuse. See Cut-outs.

BLOCKS, Meter Testing.

Hart Mfg. Co., Hartford, Conn.

BLOCKS, Moulding. See Moulding Fittings.

BLOWERS AND EXHAUSTERS, Motor Driven.

Emerson Electric Mfg. Co., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.
Mechanical Appliance Co., Milwaukee, Wis. "Watson".
Sprague Electric Works, New York.
Roth Bros. & Co., Chicago, Ill.

BLOWERS, Organ (Motor Driven).

Crocker-Wheeler Co., Ampere, N. J.
Diehl Mfg. Co., Elizabethport, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
Roth Bros. & Co., Chicago, Ill.

BLUE PRINTING MACHINERY, Electrical.

General Electric Co., Schenectady, N. Y.
Buckeye Engine Co., Salem, Ohio.
Keuffel & Esser Co., Hoboken, N. J. "Champion". "Federal".
C. F. Pease Co., Chicago, Ill. (Cutting and Trimming Table.)
Revolute Machine Co., New York. "McAdam". "Everett".
Shaw Blue Print Machine Co., Newark, N. J.
C. J. Toerring Co., Philadelphia, Pa. (Blue Print Drying Machine.)
Topping Bros., New York. "Mechanicograph".
J. H. Wagonhorst & Co., Youngstown, Ohio.
Williams, Brown & Earle, Philadelphia, Pa. "Express". "Franklin".

BOILER FLUE EXPANDERS. See Expanders.

BOILERS, Steam.

Archer & Baldwin, New York.
Babcock & Wilcox Co., New York. "Cahall". "Stirling". "A. & T.". "Rust".
Westinghouse, Church, Kerr & Co., New York, N. Y.
Bigelow Co., New Haven, Conn. "Bigelow-Hornsby".
Casey-Hedges Co., Chattanooga, Tenn.
Edge Moor Iron Co., Edge Moor, Del.
Erie City Iron Works, Erie, Pa.
Fairbanks-Mc Co., Chicago.
Franklin Boil ks Co., Troy, N. Y.
Harrisburg Foundry & Machine Co., Harrisburg, Pa. "Star".
Hawkes Boiler Co., Chicago.
Heine Safety Boiler Co., St. Louis, Mo.
E. Keeler Co., Williamsport, Pa.
McNaul Boiler Mfg. Co., Toledo, Ohio.
Milne Water Tube Boiler Co., New York.
Minneapolis Steel & Machinery Co., Minneapolis, Minn.
Murray Iron Works Co., Burlington, Iowa.
New York Safety Steam Power Co., New York.
Oil City Boiler Works, Oil City, Pa. "Geary".
Parker Boiler Co., Philadelphia.
Roth Engineering Co., South Framingham, Mass.
Toledo Flanner Boiler Co., Toledo, O. "Flanner".
Tudor Boiler Mfg. Co., Cincinnati, Ohio. "Lynn".
Wickes Boiler Co., Saginaw, Mich.

BOLTS, Expansion.

Hubbard & Co., Pittsburgh, Pa.
Van Expansion Bolt Mfg. Co., Chicago.
Brohard Co., Philadelphia, Pa.
Isaac H. Church, South Norwalk, Conn. "Perfect". "Duplex". "O. K."
Diamond Expansion Bolt Co., New York. "Keystone". "Diamond".
F. H. Evans, Brooklyn, N. Y. "Crescent".
McCabe Hanger Mfg. Co., New York, N. Y.
St. Louis Malleable Casting Co., St. Louis, Mo.
A. C. Seaman, Philadelphia, Pa.
Star Expansion Bolt Co., New York. "Sebco".
Steward & Romaine Mfg. Co., Philadelphia, Pa. "Ahlstrom".
Thos. Wrigley Co., Chicago, Ill.
Yonkers Specialty Co., Yonkers, N. Y. "Metropolitan".

BOLTS, Toggle. See Toggle bolts.

BONDS, SHARES AND SECURITIES.

Electric Bond & Share Co., New York, N. Y.

BOOKS, Technical.

Electrical Review Pub. Co., Chicago, Ill.
D. Van Nostrand Co., New York.

BOOSTERS.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Ridgeway Dynamo & Engine Co., Ridgeway, Pa.
Triumph Electric Co., Cincinnati.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

BOWLS, Glass. See Glassware.

BOXES, Battery. See Battery Boxes.

BOXES, Conduit.

Adapti Mfg. Co., Cleveland, O.
Appleton Electric Co., Chicago, Ill. (Loom, Knockout). "No Thread". "Unlets".
Arrow Electric Co., Hartford, Conn. (Switch.)
Benjamin Electric Mfg. Co., Chicago, Ill. (Weatherproof.)
Bossert Co., Utica, N. Y.
Central Electric Co., Chicago, Ill.
Chelton Electric Co., Philadelphia, Pa.
Chicago Fuse Mfg. Co., Chicago, Ill. "Union" Sectional.
Columbia Metal Box Co., New York.
Cutter Co., Philadelphia, Pa. "Munit" Switch Box.
Federal Sign System (Electric), Chicago, Ill.
Hart Mfg. Co., Hartford, Conn. "Diamond H." Switch Boxes.
J. Gordon Knight Electric Co., New York.
Machen & Mayer Electrical Mfg. Co., Philadelphia, Pa. "M. & M." Switch Boxes.
W. R. Ostrander & Co., New York.
H. T. Paiste Co., Philadelphia, Pa. "Pipe Tapiets".
Pass & Seymour, Inc., Solvay, N. Y.
Sprague Electric Works, New York. "Multilet".
Steel City Electric Co., Pittsburgh, Pa., "Star" Stamped Steel Outlet Box, "Fullman". "Steel City". "S. C." Extensions Collar. "Flexbox."
Thomas & Betts Co., New York. "Universal" and "Stahley" Outlet Boxes, "T. & B." Cable Boxes.
Advance Mfg. Co., Pittsburgh, Pa. "Heinz."
American Specialty Co., Syracuse, N. Y. "Boxet".
Barlow Foundry Co., Newark, N. J.
W. A. Bonnell Co., New York. "All-Let".
James F. Burns, Philadelphia, Pa. "V. V."
Wm. H. Colgan Co., West Newton, Mass. "Rex".
Crouse-Hinds Co., Syracuse, N. Y. "Condulets".
Economy Switchbox & Mfg. Co., Cleveland, Ohio. ("E. Z." Switch Box.)
Fancieve Specialty Co., Jamaica Plain, Mass.
Frederick Elder Co., Bridgeville, Pa. (Switch Box.)
Hart & Hegeman Mfg. Co., Hartford, Conn. ("H. & H." Switch-Boxes.)
H. Krantz Mfg. Co., Brooklyn, N. Y. (Elevator Box.)
M & H Switchbox Co., Youngstown, Ohio.
Newton Hublinger, Akron, Ohio. "New Hub."
New England Machine & Electric Co., Pawtucket, R. I.
Otis Elevator Co., New York, N. Y. (Elevator Box.)
Pratt-Chuck Co., Frankfort, N. Y.
Renim Specialty Co., Brighton Station, Boston, Mass.
Robb & Blackmer, Boston, Mass.
Seidler-Miner Electric Co., Detroit, Mich. Marine.
Standard Electric Fittings Co., Stamford, Conn.
Star Metal Box Co., New York.
Stecker Elec. & Mach. Co., Detroit, Mich.
Thayer-Buck Elec. Co., Farmington, N. H. "Jem".
Yonkers Electric Mfg. Co., Yonkers, N. Y., "Youman's" Watertight.

BOXES, Floor.

Frank Adam Electric Co., St. Louis, Mo.
Bossert Co., Utica, N. Y.
Central Electric Co., Chicago, Ill.
Federal Sign System (Electric), Chicago. "Adjustable".
General Electric Co., Schenectady, N. Y.
Machen & Mayer Elec. Mfg. Co., Philadelphia.
Manhattan Electrical Supply Co., New York. "Mesco".
Stanley & Patterson, New York. "Fielding". "Patterson".
Steel City Electric Co., Pittsburgh, Pa. "Fullman".
Thomas & Betts Co., New York. "Stahley", "Columbus".
W. A. Bonnell Co., New York.
Wm. A. Colgan Co., West Newton, Mass. "Rex".
Conlan Electric Co., New York.
Electric Supply Co., Columbus, Ohio.
John Fountain, Inc., Brooklyn, N. Y. "Acme Adjustable", "Gem".
Irish Electric Co., W. F., New York. "Shamrock".
J. Lang Electric Co., Chicago, Ill. "Quixet".
Lord Mfg. Co., New York. "Knickerbocker".
Russell & Stoll Co., New York.
United Electrical Construction Co., Chicago, Ill.

BOXES, Jack.

American Electric Co., Chicago.
Garl Electric Co., Akron, Ohio.
Standard Tel. Mfg. Co., Portsmouth, Ohio.

BOXES, Junction. (See Boxes, Conduit.)

BOXES, Manhole.

Columbia Metal Box Co., New York.
D & W Fuse Co., Providence, R. I.
General Electric Co., Schenectady
H. W. Johns-Manville Co., New York.
Standard Underground Cable Co. Pittsburgh, Pa.
G. & W. Electric Specialty Co., Chicago, Ill.

BOXES, Outlet. See Boxes, Conduit.

BOXES, Service, Sheet Steel and Cast Iron Entrance Boxes and Panelboard Cabinets.

Frank Adam Electric Co., St. Louis, Mo.
Adapti Mfg. Co., Cleveland, O.
F. Bissell Co., Toledo, Ohio. "Security" Cabinets.
Brady Electric Mfg. Co., New Britain, Conn.
Columbia Metal Box Co., New York. "Christensen".
Connecticut Electric Mfg. Co., Bridgeport, Conn.
Federal Sign System (Electric), Chicago, Ill.
General Electric Co., Schenectady.
Hamilton Sheet Metal Co., Hamilton, Ohio.
H. W. Johns-Manville Co., New York.
Machen & Mayer Electrical Mfg. Co., Philadelphia, Pa. "M. & M." Steel Panel Boxes.
W. N. Matthews & Bro., St. Louis, Mo.
National Metal Molding Co., Pittsburgh, Pa.
H. T. Paiste Co., Philadelphia.
Trumbull Electric Mfg. Co., Plainville, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Agutter & Griswold Co., Seattle, Wash.
Ahlstead Mfg. Co., Rochester, N. Y.
Allsteelequip Co., Aurora, Ill.
American Electric Switch Co., Springfield, Mass.
J. Andrae & Sons Co., Milwaukee, Wis.
Ashland Electric Co., Chicago.
W. A. Bonnell Co., New York.
Bryant Elec. Co., Bridgeport, Conn.
James F. Burns, Philadelphia, Pa.
Carstarphen Elec. Co., Denver, Colo.
Cleveland Switchboard Co., Cleveland, Ohio. (Cabinets.)
Commercial Switchboard Mfg. Co., Denver, Colo. (Steel.)
Consolidated Sheet Metal Works, Milwaukee, Wis.
T. F. Corcoran & Co., Chicago.
Crouse-Hinds Co., Syracuse, N. Y.
Cuthbert Electrical Mfg. Co., Chicago, Ill.
Delta-Star Electric Co., Chicago.
Electric Apparatus Co., Chicago, Ill.
Evans-Dickson Co., Tacoma, Wash.
Fancieve Specialty Co., Jamaica Plain, Mass.
Sam'l Garvin & Co., Chicago, Ill.
Graves Switch Box Co., Cleveland, Ohio.
Greater New York Paper Box Co., New York.
Geo. Heinemann & Co., Philadelphia, Pa.
Hinsdill Electric Co., Troy, N. Y.
J. P. Mfg. Co., Niverville, N. Y.
James S. Johnston Mfg. Co., Utica, N. Y. ("Reserve" Fuse Box.)
Kirtland Elec. Construc. Co., Albany, N. Y.
H. Krantz Mfg. Co., Brooklyn.
Kruse Electrical Mfg. Co., Ft. Wayne, Ind. (Cabinets.)
J. Lang Electric Co., Chicago, Ill. "Universal".
Web. A. Lemley, New Orleans, La.
Leonard-Bundy Electric Co., Cleveland, Ohio. (Cabinets.)
Lyon Metallic Mfg. Co., Aurora, Ill.
Metropolitan Electric Mfg. Co., Long Island City, N. Y.
Milwaukee Vault & Electric Cabinet Box Co., Milwaukee, Wis.
Mutual Electric & Machine Co., Wheeling, W. Va.
Nyelec Switchboard Co., New York.
O. K. Metal Box Co., New York.
Pike Electric Mfg. Co., Anoka, Minn. "Bulltrite."
Post-Glover Electric Co., Cincinnati, O.
Pringle Electrical Mfg. Co., Philadelphia, Pa.
Renim Specialty Co., Brighton Station, Boston, Mass.
Geo. H. Rice Co., Brooklyn, N. Y.
Rochester Switchboard Co., Rochester, N. Y. (Cabinets.)
Geo. F. Rohn, Milwaukee, Wis.
Rohrback & McDonald, Tacoma, Wash.

Schmidt Electric Co., Milwaukee, Wis. (Steel Cabinets.)
Star Metal Box Co., New York.
States Electric Co., Chicago.
Trio Mfg. Co., Rock Island, Ill.
Troy Electric Co., Troy, N. Y. "Teco".
Worcester Electric & Mfg. Co., Worcester, Mass.
Wm. Wurdack Electric Mfg. Co., St. Louis, Mo.
George H. Young, Elmira, N. Y.

BOXES, Spark Coil (Waterproof).
Stanley & Patterson, New York. "Watertite".
Churchill Cabinet Co., Chicago, Ill.
Household Cabinet Works, Providence, R. I.
Standard Cabinet Mfg. Co., Peru, Ind.
Union Hardware Co., Torrington, Conn.
F. M. West Box Co., Springfield, Mass.

BOXES, Starting. See Rheostats.

BOXES, Switch. See Boxes, Conduit.

BOXES, Wood. (Telephone Boxes; Wood Cabinets.)
Machen & Mayer Electrical Mfg. Co., Philadelphia, Pa. "M. & M." Wood Panel Boxes.
Almstead Mfg. Co., Rochester, N. Y.
American Hardwood Mfg. Co., Grottoes, Va.
Ashland Electric Co., Chicago.
Bauerle & Stark Co., Chicago, Ill.
Churchill Cabinet Co., Chicago.
Columbia Machine Works & Malleable Iron Co., Brooklyn, N. Y. (Fuse Boxes.)
Corcoran & Co., Chicago, Ill.
Crouse-Hinds Co., Syracuse, N. Y. Panel Boxes.
Findeisen & Kropf Mfg. Co., Chicago, Ill.
F. L. Heyden Co., Chicago, Ill.
Interstate Electric & Mfg. Co., Sioux City, Iowa.
Plymouth Novelty Mfg. Co., Plymouth, Ind.
Wm. Thies & Son, Huntingburg, Ind.
Ernest Topf, New York.
Wabash Cabinet Co., Wabash, Ind.
Wisconsin Chair Co., Port Washington, Wis.

BRACES, Cross Arm.
F. Bissell Co., Toledo, Ohio. "Security".
Hubbard & Co., Pittsburgh, Pa.
Line Material Company, South Milwaukee, Wis.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Benicia Iron Works, San Francisco, Cal.
Buffalo Steel Co., Tonawanda, N. Y.
Cleveland Galvanizing Works Co., Cleveland, Ohio.
Creaghead Engrg. Co., Cincinnati, Ohio.
Hallett Iron Works, Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Kinsey Mfg. Co., Toledo, Ohio. (Back Brace.)
M. Lanz & Sons, Pittsburgh, Pa.
Fred L. Meckel, Chicago, Ill.
Michigan Bolt & Nut Works, Detroit, Mich.
Newhall Chain, Forge & Iron Co., New York.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Schaper Construction Material Co., New York, N. Y.

BRACKETS, Arc Lamp (for outdoor and shop use).
Geo. Cutter Co., South Bend, Ind.
Line Material Co., So. Milwaukee, Wis.
Fletcher Mfg. Co., Dayton, Ohio.
Lundin Electric & Mach. Co., Boston, Mass.
McCrosky-Reamer Co., Meadville, Pa.
Mott Iron Works, J. L., New York, N. Y.
Philadelphia Electric Mfg. Co., Philadelphia.
Wheeler Reflector Co., Boston, Mass.

BRACKETS, ARMS AND PINS (Iron).
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Brady Electric Mfg. Co., New Britain, Conn.
Geo. Cutter Co., South Bend, Ind.
Electrical Engineers' Equipment Co., Chicago, Ill.
Hubbard & Co., Pittsburgh, Pa. ("Pierce" Insulator Brackets).
Line Material Co., So. Milwaukee, Wis. (Steel and Malleable.)
Arthur Bros., Manchester, N. H. (Adjustable Break Arms).
Creaghead Engrg. Co., Cincinnati O. "Flexible".
Delta-Star Electric Co., Chicago.
Diamond Steel Pole Co., Philadelphia, Pa.
Electric Railway Equipment Co., Cincinnati, Ohio.
Electric Service Supplies Co., Philadelphia, Pa. "Keystone".
Fletcher Mfg. Co., Dayton, Ohio.
Frank B. Hall, Newton Falls, Ohio, (Pressed Steel Brackets).
Hallett Iron Works, Chicago, Ill.
Harvard Electric Co., Chicago, Ill.
M. Lanz & Sons, Pittsburgh, Pa.
Naugatuck Malleable Iron Co., Naugatuck, Conn. "Beardsley".
Ohio Brass Co., Mansfield, Ohio.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Philadelphia Electric Mfg. Co., Philadelphia.
Pittsburgh Trolley & Forge Co., Pittsburgh, Pa.
St. Louis Malleable Casting Co., St. Louis, Mo. (Brackets and Fret Insertion Pins).

BRACKETS, Pothead.
F. Bissell Co., Toledo, Ohio. "Security".
Electrical Engineers' Equipment Co., Chicago.
Fairmount Electric & Mfg. Co., Philadelphia, Pa.
Philadelphia Electric Mfg. Co., Philadelphia.

BRACKETS, Telephone. (For supporting Telephone Instruments).
American Steel & Wire Co., Chicago. "Peerless Fonarm".
Manhattan Electrical Supply Co., New York. "Mesco".
Stanley & Patterson, New York. "Imperial".
Alliance Specialty Mfg. Co., Alliance, Ohio.
American Electric Co., Chicago, Ill., "Burns".
Chicago Writing Machine Co., Galesburg, Ill. "Adjustophone".
Connecticut Telephone & Electric Co., Meriden, Conn.
Frank B. Cook, Chicago.
De Veau Telephone Mfg. Co., Brooklyn, N. Y. "Victor".
Holtzer-Cabot Electric Co., Brookline, Mass.
K. & B. Co., Philadelphia, Pa.
McLeod-Ward & Co., New York. "Ward".
Mellink Mfg. Co., Toledo, Ohio.
Oliver Mfg. Co., Philadelphia, Pa. "Ad-a-link". "Equipoise".
Seely Office Appliance Co., New York.
Swedish-American Tel. Co., Chicago, Ill. "Radio".
C. L. Van Akin, Jr., Liverpool, N. Y.
Warner Electric Co., Muncie, Ind.
Wilhelm Telephone Mfg. Co., Buffalo, N. Y.

BRACKETS, Wood. See Pins.

BRAKES, Electric—Magnetic.
Electric Controller & Mfg. Co., Cleveland, Ohio.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

BRAKES, Dynamo.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Independent Electric Mfg. Co., Milwaukee, Wis.

BRAKES, Electric.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Sundh Electric Co., New York.
Western Electric Co., New York.

BRANCH BLOCKS. See Cut-Outs, also Moulding Blocks.

BRANDING IRONS. See Soldering Irons.

BRASS AND COPPER (In Bars, Rods and Sheets).
Bridgeport Brass Co., Bridgeport, Conn.
Ansonia Brass & Copper Co., New York.
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Coe Brass Mfg. Co., Torrington, Conn.
Detroit Copper & Brass Rolling Mills, Detroit, Mich.
Hendrick Bros., New York.
O. T. Hungerford Brass & Copper Co., New York.
C. G. Hussey & Co., Pittsburgh, Pa.
Manhattan Brass Co., New York.
New Haven Copper Co., Seymour, Conn.
New Jersey Tube Co., Harrison, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Randolph-Clowes Co., Waterbury, Conn.
Rome Brass & Copper Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Taunton-New Bedford Copper Co., Taunton, Mass.
Waterbury Brass Co., Waterbury, Conn.

BRASS TUBING. See Tubing.

BREAK ARMS. See Brackets, Arms and Pins.

BRIDGES.
American Bridge Co., New York.

BRIDGES, Railroad and Highway.
American Bridge Co., New York.

BRIDGES AND TOWERS, Coal Handling.
American Bridge Co., New York.

BRUSHES. Carbon and Graphite.
Central Electric Co., Chicago.
Chas. E. Chapin Co., Inc., New York.
Joseph Dixon Crucible Co., Jersey City, N. J.
General Electric Co., Schenectady, N. Y.
Holmes Fibre Graphite Mfg. Co., Philadelphia, Pa.
W. J. Jeandron, New York. (Importer "Le Carbone.")
Le Valley Vitae Carbon Brush Co., New York, N. Y.
Morgan Crucible Co., Ltd., New York.
National Carbon Co., Cleveland.
Nungesser Carbon & Battery Co., Cleveland, Ohio.
Pure Carbon Co., Wellsville, N. Y.
Hugo Reisinger, New York. (Importer "Brouskol").
Triumph Electric Co., Cincinnati, O.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
American Carbon & Battery Co., East St. Louis, Ill.
Barkelew Electric Mfg. Co., Middletown, Ohio. "Sparkless."
Baylis Co., Bloomfield, N. J.
Becker Bros., Chicago, Ill. "Perfection."
Chicago Carbon Co., Chicago, Ill.
French Battery & Carbon Co., Madison, Wis. (Importers.)
Hart & Co., Fostoria, Ohio. "Langleben."
Speer Carbon Co., St. Marys, Pa. "Long Life."
Stackpole Carbon Co., St. Marys, Pa.
United States Carbon Co., New York. "U. S. Emcient."
Van Nont Carbon Brush Co., St. Louis, Mo.

BRUSHES, Metallic.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Central Electric Co., Chicago.
Chas. E. Chapin Co., Inc., New York, N. Y.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
National Carbon Co., Cleveland, O. "Cophite."
Nungesser Carbon & Battery Co., Cleveland, O.
Triumph Electric Co., Cincinnati, O.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Berkelew Electric Mfg. Co., Middletown, Ohio.
Crown Woven Wire Brush Co., Salem, Mass.
Chemelectric Co., Chicago. "Lubricating Brushes."
Eureka Tempered Copper Works North East, Pa. (Sheet Metal.)
James Goldmark Co., New York. "German-American."
Hart & Co., Fostoria, Ohio.
James E. McMurty & Co., Chicago, Ill.
Ohio Electric Specialty & Mfg. Co., Troy, Ohio. "Perfection".
Philadelphia Elec'l & Mfg. Co., Philadelphia, Pa. (Sheet Metal.)
Thompson-Bonney Co., Brooklyn, N. Y. "Acme".
United States Carbon Co., New York.

BRUSHES, Pneumatic.
(For larger sizes, see Air Compressors.)
Bishop & Babcock Co., Cleveland, O.
Chicago Pneumatic Tool Co., Chicago, Ill.
General Compressed Air House Cleaning Co., St. Louis, Mo.
Kny-Scheerer Co., New York.
Paasche Air Brush Co., Chicago.
Pelton & Crane Co., Detroit.
P. Pfeffer, Newark, N. J. "Universal".
Standard Automatic Mfg. Co., New York.
Victor Electric Co., Chicago, Ill., (Air Compressor Outfit.)
O. C. Wold, Chicago, Ill.

BRUSH HOLDERS.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Baylis Co., Bloomfield, N. J. "Reaction".
Par Sil Metal Co., Lansdale, Pa.

BUFFERS, Portable. See Tools, Portable.

BUILDINGS, Office and Mill.
American Bridge Co., New York.

BUNKERS AND HOPPERS.
American Bridge Co., New York.

BURGLAR ALARMS. (Window and door attachments.) (See also Matting.)
Manhattan Electrical Supply Co., New York.
W. R. Ostrander & Co., New York.
Stanley & Patterson, New York.
Edwards & Co., New York.
Otto Bernz, Newark, N. J.
Farrington & Co., Mt. Vernon, N. Y.

BURNERS, Gas Lighting.
Automatic Appliance Co., Boston, Mass. (Automobile.)
A. L. Bogart, New York. ("Bartholdi" Automatic.)
Cleverly Electric Works, Philadelphia, Pa.
Electric Goods Mfg. Co., Canton, Mass. ("Boston" Automatic, "Advance" Pendant, "Prefex" Automobile Gas Lighter.)
Holtzer-Cabot Electric Co., Brookline, Mass.
Inst. Lighter Co., Columbus, O.
Motor Specialties Co., Boston, Mass. Automobile.
J. Y. Park & Co., Philadelphia, Pa. "Jypco".
H. C. Roberts Electrical Supply Co., Philadelphia, Pa. "Victor".

BUS BARS. See Bars.

BUS BAR SUPPORTS.
Electrical Engineers' Equipment Co., Chicago.
Delta-Star Electric Co., Chicago.

BUSHINGS AND LOCKNUTS. (For Conduit.)
Appleton Electric Co., Chicago.
Bossert Co., Utica, N. Y. "Erickson" and "Monitor" Bushings.
Federal Sign System (Electric), Chicago, Ill.
General Electric Co., Schenectady, N. Y.
New Process Specialty Co., Inc., Milwaukee, Wis.
Sprague Electric Works, New York.
Steel City Electric Co., Pittsburgh, Pa. "Star" & "Fullman" Bushings.
Thomas & Betts Co., New York. "T. & B".
W. A. Bonnell Co., New York.
Condit Electrical Mfg. Co., Boston, Mass. ("Shawmut" Bushings & Locknuts.)
Electric Specialty Mfg. Co., Providence, R. I. "Boss".
S. R. Fralick & Co., Chicago. "Kwikon."
Gillette-Vibber Co., New London, Conn.
Grabler Mfg. Co., Cleveland.
Philadelphia Electric Mfg. Co., Philadelphia, Pa.
Pratt Chuck Co., Frankfort, N. Y.
Standard Electric Fittings Co., Stamford, Conn.
Star Metal Box Co., New York.

BUSHINGS, Porcelain Clamping.
Appleton Electric Co., Chicago.
Federal Sign System (Electric), Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Pass & Seymour, Inc., Solvay, N. Y.
Phelps Mfg. Co., Detroit, Mich.
W. A. Bonnell Co., New York.
Thordardson Electric Mfg. Co., Chicago.
Troy Electrical Co., Troy, N. Y.
V. V. Fittings Co., Philadelphia.

BUSHINGS, Socket.
Arrow Electric Co., Hartford, Conn.
Hemming Mfg. Co., Garfield, N. J.
Scranton Button Co., Scranton, Pa. (Composition.)
Western Electric Co., New York.
American Hard Rubber Co., New York.
Auburn Button Works, Auburn N. Y. (H. A. Caesar & Co., New York, Sole Selling Agents, (Composition.)
A. S. Brock Rubber Co., Boston, Mass.
Dickinson Mfg. Co., Springfield, Mass.
Massachusetts Chemical Co., Walpole, Mass.
Electrose Mfg. Co., Brooklyn, N. Y. (Composition.)

Siemon Hard Rubber Corporation, Bridgeport, Conn.
Frank H. Stewart Electric Co., Philadelphia, Pa. "Knostrain."

CABINETS, Iron. See Boxes, Service.

CABINETS, Wood. See Boxes, Wood.

CABLES. (See also Wire.)
American Electrical Works, Philadelphia, R. I.
American Steel & Wire Co., Chicago, Ill.
Atlantic Insulated Wire & Cable Co., New York, N. Y.
Belden Mfg. Co., Chicago, Ill.
Central Electric Co., Chicago, Ill.
Brixey, W. R., New York, N. Y.
Electric Cable Co., New York.
General Electric Co., Schenectady, N. Y.
Habirshaw Wire Co., New York.
Hazard Mfg. Co., Wilkesbarre, Pa.
Kerite Insulated Wire & Cable Co., New York, N. Y.
Moore, Alfred F., Philadelphia, Pa.
National Conduit & Cable Co., New York, N. Y.
Okonite Co., New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Safety Insulated Wire & Cable Co., New York, N. Y.
Simplex Wire & Cable Co., Boston. "Simcore", "Simplex Caoutchouc" (Simplex "B. C.").
Standard Underground Cable Co., Pittsburgh, Pa.
Waterbury Co., Waterbury, Conn.
Western Electric Co., New York.

CABLES, Armored. (Flexible.)
National Metal Molding Co., Pittsburgh, Pa. "Flexsteel."
Sprague Electric Works, New York. "Greenfield", "B-X".
Standard Underground Cable Co., Pittsburgh, Pa.
Boston Insulated Wire & Cable Co., Boston, Mass.
Flexible Conduit Mfg. Co., Penn Yan, N. Y.
Pratt Chuck Co., Frankfort, N. Y.
Safety-Amorite Conduit Co., Pittsburgh, Pa. "Sterling."
Western Conduit Co., Youngstown, Ohio. "Realflex."

CABLE BELLS. (See Potheads.)

CABLE HANGERS.
A. & J. M. Anderson Mfg. Co., Boston, Mass.
Appleton Electric Co., Chicago.
F. Bissell Co., Toledo, Ohio.
Hubbard & Co., Pittsburgh, Pa.
W. N. Matthews & Bro., St. Louis, Mo.
Mineralac Electric Co., Chicago.
Standard Underground Cable Co., Pittsburgh, Pa. "Nordyke Support."
Western Electric Co., New York.
American Cable Clip Co., New York, "Economic".
American Twist Drill Co., Laconia, N. H. "Union."
Anderson Tool & Supply Co., Detroit, Mich. (For Manholes).
Aurora Cable Clip Co., Aurora, Ill.
Baugh Cable Clip Co., Hopkinsville, Ky.
Cameron Appliance Co., Everett, Mass. "Locke".
Case-Shawmut Co., Newburyport, Mass. (Marlin.)
Chicago Nut Co., Chicago, ("Best", "A. T. & T. Co.", "Alpha" Marlin.)
Condit Electrical Mfg. Co., Boston, Mass. ("Boston Marlin.")
Frank B. Cook, Chicago, Ill.
H. P. Copeland, Jersey City, N. J. "H. P".
Diamond Expansion Bolt Co., New York, "Long Saut".
Eureka Supply Co., Sewell, N. J. "Rex".
Hallett Iron Works, Chicago, Ill.
Michigan Bolt & Nut Works, Detroit, Mich.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Pettingell-Andrews Co., Boston, Mass. "O'Neill".
Rhode Island Telephone & Electric Co., Providence, R. I. "Wright".
Star Expansion Bolt Co., New York.
Yonkers Specialty Co., Yonkers, N. Y. "I-Let", "Metropolitan".

CABLE PULLING TOOLS. (See Tools.)

CABLE RACKS. (for indoor and vault use.)
Electrical Engineers Equipment Co., Chicago.
General Electric Co., Schenectady, N. Y.
Standard Underground Cable Co., Pittsburgh, Pa.
Frank B. Cook, Chicago.
T. J. Cope, Philadelphia.

CABLE ROLLERS.
Fairmount Electric & Mfg. Co., Philadelphia, Pa.
W. N. Matthews & Bro., St. Louis, Mo.

CABLE SPLICING JOINTS.
W. N. Matthews & Bro., St. Louis, Mo.

CABLE SUPPORTING CLAMPS. (See Clamps, Cable Supporting.)

CABLE TESTERS. (See also instruments, Testing.)
W. N. Matthews & Bro., St. Louis, Mo.
Mineralac Electric Co., Chicago.
Standard Underground Cable Co., Pittsburgh, Pa.

CABLING MACHINES. (See also Covering Machines.)
New England Butt Co., Providence, R. I.

CALIBRATORS, Meter.
Fort Wayne Electric Works, Ft. Wayne, Ind. "Wood".
General Electric Co., Schenectady, N. Y.
Sangamo Electric Co., Springfield, Ill.
Columbia Meter Co., Indianapolis, Ind.

CALLS, Carriage. (See Carriage Calls.)

CANDLES, Electric. (See Flashlights.)

CANDLES, Glass, Candelabra Fixtures.
Phoenix Glass Co., New York.
Fensterer & Ruhe, New York, N. Y.
Gill & Co., Washington Flint Glass Works, Philadelphia, Pa.
Gleason-Tiebout Glass Co., Brooklyn, N. Y.
H. G. McFaddin & Co., New York. (Importers.)

CANOPY INSULATORS.
General Electric Co., Schenectady, N. Y.
Mica Insulator Co., New York, N. Y. "Young".
E. E. Bechtold, Chicago, Ill. "E. E. B."
Dale Co., New York, N. Y.
Macallen Co., Boston, Mass.
The Mitchell-Vance Co., New York.
J. H. Parker, Boston, Mass. "Trio".

CANOPIES, Fixture. See Shells, Chandelier.

CAPS, Conduit. See Fittings, Conduit.

CAPS, Inc. Lamp, Color Caps.
Reynolds Elec. Flasher Mfg. Co., Chicago, Ill.
A. & W. Electric Sign Co., Cleveland, Ohio.
Betts & Betts, New York.
Lord Mfg. Co., New York.

CAPSTANS, Cable Pulling. (See Tools, Cable Pulling.)

CARBONS, Arc Light.
Central Electric Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Koerting & Mathiesen Co., New York. "Excello".
National Carbon Co., Cleveland, Ohio. "Silvertip", "Columbia", Blueprinting, "Columbia Projector, Engraving, Miniature, Photographic, Searchlight, Welding.
Hugo Reisinger, New York. (Importer) "Nuernberg", "Excello", "Electra".
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Edward E. Cary Co., New York. (Importers "Fabius Henrion").
L. E. Frorup & Co., New York. (Importers "Alba", "Siemens", "Arco").
German American Electric Co., New York. (Importers "Etna").
H. M. Hirschberg, New York, N. Y. (Importer "Plania").
Chas. L. Kiewert Co., Milwaukee, Wis. (Importers "Bio").
United States Carbon Co., New York.

CARBONS, Battery.
Manhattan Electrical Supply Co., New York.
National Carbon Co., Cleveland, Ohio.
American Carbon & Battery Co., St. Louis, Mo.
Edward E. Cary Co., New York. (Importers "Fabius Henrion".)
Chicago Carbon Co., Chicago, Ill.
Speer Carbon Co., St. Marys, Pa.
Stackpole Carbon Co., St. Marys, Pa. (Pencil only.)
Telephone Carbon Co., Brooklyn, N. Y.

CARBON SPECIALTIES.
Circuit-breaker contacts, crucibles, diaphragms, discs, globular carbon, granular carbon, lightning arresters, packing rings, plungers, rods, sticks, tubes, welding carbons.
National Carbon Co., Cleveland, Ohio.

CAR HEATING, Electric.
H. W. Johns-Manville Co., New York.
Simplex Electric Heating Co., Cambridge, Mass.
Western Electric Co., New York.

CAR LIGHTING SYSTEMS.
Gould Storage Battery Co., New York.
United States Light & Heating Co., New York. "United States", "Bliss", "Moskowitz".
Consolidated Car Heating Co., Albany, N. Y.
Consolidated Ry. Elec. Ltg. & Equipment Co., New York. "Axle Light".
Dake-American Steam Turbine Co., Grand Rapids, Mich.
Safety Car Heating & Lighting Co., New York. (Axle Driven Dynamo.)

CARRIAGE CALLS.
Edwards & Co., New York.
Electric Carriage Call & Specialty Co., New York.

CARS, Derrick.
American Bridge Co., New York.

CARS, Messenger or Cable. (See Trolleys.)

CARTS, Linemen's.
Mathias Klein & Sons, Chicago.
Oshkosh Mfg. Co., Oshkosh, Wis.
Dicke Tool Co., Downers Grove, Ill.

CASES, Battery. See Battery Holders.

CASTINGS.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Faries Mfg. Co., Decatur, Ill.
New England Butt Co., Providence, R. I.
Stanley & Patterson, New York. "Bestelectric".
Triumph Electric Co., Cincinnati, Ohio.
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Fee & Mason, New York.
Industrial Novelty Co., Chicago, Ill.
Inventor's & Mfgr's Sales Co., San Francisco, Cal. "Marvelous".
Knoblock-Heideman Mfg. Co., South Bend, Ind.
Mahoney Bros., Chicago, Ill. "Chicago".
Metal Specialties Mfg. Co., Chicago, Ill. "Presto".
Minneapolis Steel & Machinery Co., Minneapolis, Minn.
Standard Mfg. Co., Auburn, Ind. "Crown" (Pendant.)
Wallace Foundry & Mach. Co., Lafayette, Ind.
Wolff & Co., Alfred, New York.

CEILING FANS.
See Fans.

CEMENT, Cable, Transformer.
Massachusetts Chemical Co., Walpole, Mass.

CEMENT, Commutator Repairing.
See Commutator Cement.

CEMENT MACHINERY.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

CHAINS, Arc Lamp Hoisting.
Oneida Community, Ltd., Oneida, N. Y.

CHAIN, Chandelier.
E. C. Bliss Mfg. Co., Providence, R. I.
Virden Mfg. Co., Cleveland, Ohio.
Woodhouse Chain Works, Trenton, N. J.

CHAIN, (for Pull Sockets).
Arrow Electric Co., Hartford, Conn.

CHAINS, Cable Stringing.
See Trolleys.

CHAINS, Drive.
See Belting.

CHANDELIERS (See also Fixtures.)
Beardslee Chandelier Mfg. Co., Chicago, Ill.
Central Electric Co., Chicago, Ill.
Tungstolier Works of General Electric Co., Cleveland, O.

CHANGERS. See Lamp Changers.

CHANGERS, Pole.
See Pole Changers.

CHARGING OUTFITS.
(For Charging Storage Batteries on D. C. Circuits. For A. C. Circuits, see Rectifiers.)
Crocker Wheeler Co., Ampere, N. J. (Motor Generators.)
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y. (Motor Generator.)
Mechanical Appliance Co., Milwaukee, Wis.
Burke Electric Co., Erie, Pa. (Dynamo Charging System.)
Ideal Electric Mfg. Co., Mansfield, Ohio. (Dynamo Charging System.)
Kendrick & Davis Co., Lebanon, N. H. (Dynamo Charging System.)
Lincoln Electric Co., Cleveland, Ohio. (Motor Generators.)
E. Marcuson, New York. "Witham Charging Board".
O'Brien Electrophone Co., Hallowell, Me. (Dynamo Charging System.
Vesta Accumulator Co., Chicago, Ill. (For Charging Auto Lighting Battery.)

CHARGING RHEOSTATS. See Rheostats; also Stage Dimmers.

CHEMICALS, Battery.
Battery Salts, Blue Vitriol, Manganese, Sal-ammoniac.
American Electrical Works, Phillipsdale, R. I.
M. L. Barrett & Co., Chicago, Ill. (Sal-ammoniac only.)
Black Chemical Co., New York. ("Electrical" Sal Ammoniac.)
Edward E. Cary Co., New York. (Importers.)
Charles Cooper & Co., New York.
Elmer & Amend, New York.
French Battery & Carbon Co., Madison, Wis. (Importers.)
Grasselli Chemical Co., Cleveland, Ohio.
F. H. Kalbfleisch Co., New York.
A. Klipstein & Co., New York.
Merck & Co., New York.
Powers-Weightmann-Rosengarten Co., Philadelphia, Pa. "Veltak".
Roessler & Hasslacher Chemical Co., New York. "Battery Brand".
Charles E. Sholes Co., New York.
S. S. White Dental Mfg. Co., Philadelphia, Pa. "Parts"
Sulpho-Chromic Salt.

CHOKE COILS.
A. & J. M. Anderson Mfg. Co., Boston, Mass.
General Electric Co., Schenectady, N. Y.
Hickey & Schneider, New York, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Delta-Star Electric Co., Chicago.
Electric Service Supplies Co., Philadelphia, Pa.
Lord Mfg. Co., New York. (Auto-Discharge Vertical Unit.)

CHOPPERS, Meat.
See Meat Choppers, Electric.

CHRISTMAS TREE OUTFITS.
See Decorative Lighting.

CHRONOGRAPHS. See Time Stamps.

CHURNS. See Dairy Apparatus.

CIGAR LIGHTERS.
Diamond Electric Co., Binghamton, N. Y.
General Electric Co., Schenectady, N. Y.
Helion Electric Co., Newark, N. J.
Simplex Electric Heating Co., Cambridge, Mass.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Adjustable Lighter Co., Newton, Mass. "Universal".
American Ever Ready Co., New York. "Every Ready".
Carstarphen Electric Co., Denver, Colo.
C. Cowles & Co., New Haven, Conn.
Eldred Mfg. Co., Chicago, Ill. "Wizard".
Pittsburg Electric Specialties Co., Pittsburg, Pa.

CIRCUIT BREAKERS, Automatic
Cant-Westburg Electric Co., Inc., Chicago.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Cutter Co., Philadelphia, Pa. "Dalite" "I-T-E".
Fort Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Hickey & Schneider, New York, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Sundh Electric Co., New York.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Bowie Switch Co., San Francisco, Calif.
Condit Electrical Mfg. Co., Boston, Mass.
Hartman Circuit Breaker Co., Mansfield, O.
Janette Mfg. Co., Chicago, Ill.
Machado & Roller, New York.
Pacific Elec. & Mfg. Co., San Francisco, Calif.

Pittsburg Armature Works, Pittsburg, Pa.
Roller-Smith Co., Bethlehem, Pa.
Storm, Francis, New York. (Mercurial.)
Ward Leonard Electric Co., Bronxville, N. Y.

CLAMPS, Cable Supporting.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Electrical Engineers Equipment Co., Chicago, Ill.
W. N. Matthews & Bro., St. Louis, Mo. "Matthews".
Standard Underground Cable Co., Pittsburgh, Pa.
Diamond Expansion Bolt Co., New York. "Long Saut".
Electric Service Supplies Co., Philadelphia, Pa. (Porcelain Clamp Insulator.)
Hallett Iron Works, Chicago.
Paragon-Sellers Co., Chicago, Ill.
Special Device Co., Cincinnati, Ohio, "Bierce".

CLAMPS, Ground Connection.
See Ground Clamps.

CLAMPS, Guy.
See Guy Clamps.

CLAMPS, Insulator.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Electrical Engineers Equipment Co., Chicago, Ill.
Fairmount Electric & Mfg. Co., Philadelphia, Pa.
States Co., Hartford, Conn.
Steel City Electric Co., Pittsburgh, Pa. "Universal".
Clark Electric & Mfg. Co., New York.
Delta-Star Electric Co., Chicago.
Fletcher Mfg. Co., Dayton, Ohio.
Kinsey Mfg. Co., Toledo, Ohio.

CLAMPS, Outlet Box.
See also Conduit Fittings.
Federal Sign System (Electric), Chicago, Ill.

CLAMPS, Splicing.
See Splicing Clamps.

CLAMPS, Test.
See Test Clamps.

CLEANERS, Boiler Tube
Elliott Co., Pittsburgh, Pa.
General Specialty Co., Buffalo, N. Y. "Demon".
Liberty Mfg. Co. Pittsburgh, Pa.
Ohio Steam Specialty Co., Youngstown, O. "Hydraulic".
Wm. B. Pierce Co., Buffalo, N. Y.

CLEANERS, GLASSWARE.
Myralite Co., Pownal, Vermont.

CLEANERS AND POLISHERS, Floor. See Floor Cleaners and Polishers.

CLEANERS, Inc. Lamp.
See Changers.

CLEANERS, Switchboard.
United Electric Co., Canton, Ohio. "Ture".

CLEANERS, Vacuum. See Vacuum Cleaners.

CLEATS, Conduit.
Diamond Mfg. Co., Detroit, Mich.
L. Wolff Mfg. Co., Chicago, Ill.

CLEATS, Fibre.
Blake Signal & Mfg. Co., Boston, Mass.
General Electric Co., Schenectady, N. Y.

CLEATS, Insulating.
Hemming Mfg. Co., Garfield, N. J.
Mineralac Electric Co., Chicago.

CLIMBERS, Linemen's.
Klein & Sons, Mathias, Chicago.
Oshkosh Mfg. Co., Oshkosh, Wis. "Roberts".
Smith & Hemenway Co., New York. "Neverturn".
Western Electric Co., New York.
Blakeslee Forging Co., Plantsville, Conn. "Donnelly".
Cincinnati Tool Co., Cincinnati, Ohio "Hargrave".
Cronk & Carrier Mfg. Co., Elmyra, N. Y., "Sure Grip".
Dicke Tool Co., Downers Grove, Ill.
Kilborn & Bishop Co., New Haven, Conn.
P. Lawentraut Mfg. Co., Newark, N. J.
John J. Reidy, New Haven, Conn.
St. Johnsbury Tool Works, St. Johnsbury, Vt. "Vermont".
Wilmot Stephens, Binghamton, N. Y.

CLIPPERS, Horse. Motor Driven.
American Shearer Mfg. Co., Nashua, N. H. "Priest".
Chicago Flexible Shaft Co., Chicago, Ill.
Coates Clipper Mfg. Co., Worcester, Mass.
Gillette Clipping Machine Co., New York.
Kimble Electric Co., Chicago, Ill.
J. Irvingston & Co., New York. (Groomers.)
J. F. Packer & Sons LaGrange, Ill.
Reliable Electric Co., Chicago.
Taber Pump Co., Buffalo, N. Y. (Groomers.)

CLIPS, Cable. See Cable Hangers.

CLOCKS, Alarm. Electric.
Manhattan Electrical Supply Co., New York.
Stanley & Patterson, New York. "Diamond".
Darche Mfg. Co., Chicago, Ill. "Fine Light".
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Western Clock Mfg. Co., La Salle, Ill.

CLOCKS, Electric, Self Winding, Program.
American Watchman's Time Detector Co., New York.
H. M. Eldred, Milwaukee, Wis.
Engineering Electric Mfg. Co., Stamford, Conn.
Frick Clock Co., Waynesboro, Pa.
H. Gillette & Co., Chicago, Ill. (Secondary Clock System.)
E. Howard Clock Co., Boston, Mass.
Imperial Clock Co., St. Louis, Mo.
Industrial Instrument Co., Foxboro, Mass.
International Time Recording Co. of New York, Endicott, N. Y. "Dey", "Bundy", "Hansen".
Magneta Co., New York.
Monarch Telephone Mfg. Co., Chicago, Ill. (Time Service System in Connection with Telephone Service.)
New York Standard Watch Wks., Jersey City, N. J.
Prentiss Clock Improvement Co., New York.
Self-Winding Clock Co., Brooklyn, N. Y.
Standard Electric Time Co., Waterbury, Conn.

CLOCKS, Watchmen's.
Manhattan Electrical Supply Co., New York, N. Y.
American Watchman's Time Detector Co., New York.
Eco Magnetic Clock Co., Boston, Mass.
Edwards & Co., New York, N. Y.
E. A. Hamilton & Co., Grand Rapids, Mich. "Waggoner".
E. O. Hausburg, New York.
Holtzer-Cabot Electric Co., Brookline, Mass.
E. Howard Clock Co., Boston, Mass.
E. Imhauser & Co., New York.
Industrial Inst. Co., Foxboro, Mass.
Robert Kopp., New York.
Nanz Clock Co., New York. (Importers "Hahn".)
National Time Recorder Co., Chicago, Ill. "Twentieth Century".
Newman Clock Co., Chicago, Ill.
Riggs & Bro., Philadelphia, Pa.
Self-Winding Clock Co., Brooklyn, N. Y.
Simplex Time Recorder Co., Gardner, Mass.
Sohm Electric Signal & Recording Co., Chicago, Ill.
Watchman's Clock & Supply Co., New York.

CLOTH CUTTERS. See Cutters.

CLOTH, Insulating.
Chicago Mica Co., Valparaiso, Ind. "Champion".
Mica Insulator Co., New York. "Empire".
Packard Electric Co., Warren, O.
Standard Paint Co., New York. "P. & B.".
Standard Underground Cable Co., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
American Mfg. Co., Newton Lower Falls, Mass., "Puritan".
Massachusetts Chemical Co., Walpole, Mass.
Pittsburgh Insulating Co., Pittsburgh, Pa.
Schenectady Lionite Co., Schenectady, N. Y.
Sterling Varnish Co., Pittsburgh, Pa.

CLOTHES WASHERS.
See Washers.

CLUSTERS. (Socket combinations Alone.)
Benjamin Electric Mfg. Co., Chicago.
General Electric Co., Schenectady, N. Y.
McGill Mfg. Co., Valparaiso, Ind.
Dale Co., New York.
Faries Mfg. Co., Decatur, Ill.
Gleason-Brokaw Electric Co., St. Louis.

CLUSTER UNITS. (Lighting Fixtures with Reflectors over Clusters.)
Benjamin Electric Mfg. Co., Chicago, Ill. "Anti-Night".
Central Electric Co., Chicago, Ill.
Federal Sign System (Electric), Chicago, Ill.
H. W. Johns-Manville Co., New York, N. Y.
Line Material Co., South Milwaukee, Wis.
McGill Mfg. Co., Valparaiso, Ind. "Harter".
Phelps Mfg. Co., Detroit, Mich.
St. Louis Brass Mfg. Co., St. Louis, Mo.
Western Electric Co., New York. "Hawthorn".
American Arc Lamp Co., Kalamazoo, Mich.
Boyse-Carmichael Mfg. Co., Chicago, Ill.
Delta-Star Electric Co., Chicago.
Gleason-Brokaw Electric Co., St. Louis.
Harter Elec. Co., Chicago, Ill. (Tungsten.)
National Stamping & Elec. Wks., Chicago, Ill.
Edward J. O'Beirne & Co., Elgin, Ill. "Deflectolier".
G. E. Painter, Baltimore, Md. (For signaling trolley cars.)
W. W. Partridge Co., Chicago, Ill.
Philadelphia Electric Mfg. Co., Philadelphia, Pa.
States Electric Co., Chicago.
Tilden Saw & Mfg. Co., Wyandotte, Mich. "Mazda Arc".
Warner Arc Lamp Co., Wilton Junction, Ia. "Mazda" Tungsten.
Wheeler Reflector Co., Boston, Miss.

CLUTCHES, Magnetic.
Cutler-Hammer Clutch Co., Milwaukee, Wis.
Independent Electric Mfg. Co., Milwaukee, Wis.
Minneapolis Steel & Machinery Co., Minneapolis, Minn.

COAL HANDLING MACHINERY.
(See also Conveyors; also Scales.)
Sprague Electric. Works, New York.
C. W. Hunt Co., W. New Brighton, N. Y.
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Mfg. Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.

COAL MINING MACHINERY.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

COFFEE MILLS, Electric.
See Mills, Coffee.

COIL FORMING DEVICES. (For making armature coils.)
Comstock & Co., Wilkesbarre, Pa.
Electrical Mfrs. Equipment Co., Chicago.
Exeter Machine Works, Pittston, Pa.

COILS, Armature and Field.
Belden Mfg. Co., Chicago, Ill.
D & W Fuse Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
John A. Roebling's Sons Co., Trenton, N. J.
American General Trading Co., New York. "A. G. E."
Chattanooga Armature Works, Chattanooga, Tenn.
Cleveland Armature Wks., Cleveland, Ohio.
Columbia Machine Works & Malleable Iron Co., Brooklyn, N. Y.
Cross Electric Co., Hoboken, N. J.
Dittrick & Jordan Electric Co., Cleveland, Ohio.
Doubleday-Hill Elec. Co., Pittsburgh, Pa.
Electric Traction Supply Co., St. Louis, Mo.
S. K. Elliott Elec. Co., Cleveland, Ohio.
Elliott-Thompson Electric Co., Cleveland, Ohio.
Feval Enamel Insulated Wire Co., Chicago, Ill.
Illinois Electrical Mfg. Co., Peoria, Ill.
Oliver Electric & Machine Co., Birmingham, Ala.
Frank Ridlon Co., Boston, Mass.
Stimple & Ward Co., Pittsburgh, Pa.
S. J. Stewart, New Orleans, La.
Wood Elec. & Mfg. Co., South Bend, Ind.

COILS, Choke. See Choke Coils.

COILS, Wound. Induction, Ignition, Gas Lighting, Spark, Magnet.
American Electrical Works, Philipsdale, R. I.
Belden Mfg. Co., Chicago, Ill.
D & W Fuse Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
Kellogg Switchboard & Supply Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York. "Mesco".
Menominee Electric Mfg. Co., Menominee, Mich.
W. R. Ostrander & Co., New York.
Stanley & Patterson, New York. "Patterson". (Screw Top.)
Vote-Berger Co., La Crosse, Wis.
Western Electric Co., New York. "Hawthorn".
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Acme Wire Co., New Haven, Conn.
Auto Coil Co., Jersey City, N. J. "Owners", "Jumphiame".
J. H. Bunnell & Co., New York.
James H. Cary, Portland, Me.
Central Insulating Co., La Fayette, Ind. (X-Ray and Wireless.)
Connecticut Telephone & Electric Co., Meriden, Conn.
Dayton Electrical Mfg. Co., Dayton, Ohio. "Apple".
Dow Mfg. Co., Braintree, Mass.
Duplex Coil Co., Fond du Lac, Wis.
Electric Goods Mfg. Co., Canton, Mass. "Perfex".
Electro Importing Co., New York.
H. P. Engeln & Co., Cleveland, Ohio.
Feval Enamel Insulated Wire Co., Chicago, Ill.
Holtzer-Cabot Electric Co., Brookline, Mass.
Industrial Novelty Co., Chicago.
International Brass & Elec. Co., New York, N. Y.
Kelly-Koett Mfg. Co., Covington, Ky.
Knoblock-Heideman Mfg. Co., South Bend, Ind.
Lemke Electric Co., Milwaukee, Wis. "L. B."
Lindsley-Allen Electrical Co., Providence, R. I. ("Paracoil" Spark and "Solcoil" Induction.)
McIntosh Battery & Optical Co., Chicago, Ill.
Wm. Meyer Co., Chicago, Ill.
National Coil Co., Lansing, Mich. "Capitol".
New York Coil Co., New York. "Fire Ball", "Economic".
C. Noxon Per Lee, Syracuse, N. Y.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Fred'k Pearce Co., New York.
Pfanstiehl Electric Laboratory, North Chicago, Ill. (X-ray.)
Pittsfield Spark Coil Co., Dalton, Mass.
P. R. Mfg. Co., Detroit, Mich.
Queen-Gray Co., Philadelphia, Pa.
Roentgen Mfg. Co., Philadelphia, Pa. "Jumbo".
W. A. Russell & Co., New York.
Scheidel-Western X-Ray Coil Co., Chicago, Ill.
Schug Electric Mfg. Co., Detroit, Mich.
Seidler-Miner Electric Co., Detroit, Mich.
C. F. Spitzdorf Co., New York.
Standard Tel. Mfg. Co., Portsmouth, Ohio.
Thordarson Electric Mfg. Co., Chicago, Ill.
Tritt Electric Co., Union City, Ind.
Victor Electric Co., Chicago, Ill. "Wantz".
Wappler Electric Mfg. Co., New York. "Tesla" (Medical.)
Western Tel. Mfg. Co., Chicago.
Williams, E. Q., Syracuse, N. Y.
Witherbee Igniter Co., Springfield, Mass.

COILS, Resistance.
Badt-Westburg Electric Co., Inc., Chicago.
Belden Mfg. Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
J. H. Bunnell & Co., New York.
Feval Enamel Insulated Wire Co., Chicago.
W. & L. E. Gurley, Troy, N. Y. "Decade".
International Brass & Electric Co., New York.
Kellogg Switchboard & Supply Co., Chicago, Ill.
Machado & Roller, New York. (Sole Selling Agents for Roller-Smith Co., Bethlehem, Pa.)
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Queen-Gray Co., Philadelphia, Pa.
Thordarson Electric Mfg. Co., Chicago, Ill.
Ward Leonard Electric Co., Bronxville, N. Y.
Western Tel. Mfg. Co., Chicago.

COIL, Spark. See Coils, Induction.

COLOR CAPS. See Caps.

COLORING (For Incandescent Lamps.)
McGill Mfg. Co., Valparaiso, Ind. "Crescent".
Universal Electric Stage Lighting Co., New York. "Signaloid", "Kliegl Bros."
L. B. Allen Co., Chicago, Ill.
M. L. Barrett & Co., Chicago, Ill.
Brunner Chemical Works, Cincinnati, Ohio. "Queen".
Celluloid Zapon Co., New York.
Egyptian Lacquer Mfg. Co., New York.
C. E. Franche & Co., Chicago, Ill. "Permacolor".
Globe Electric Specialties Co., New York. "Globoid".
Lacquer Radiant Co., Philadelphia, Pa. "L. R. C."
Pacific Electric Co., La Crosse, Wis. "Karaline", "Inline".
Webster Chemical Co., St. Paul, Minn. "Crystal".

COLOR-MATCHING OUTFITS.
General Electric Co., Schenectady.

COMBUSTION RECORDERS.
See Recorders.

COMEALONGS (Wire Stretchers).
Mathias Klein & Sons, Chicago, Ill. "Landee's", "Samson", "American Grip", "Chicago Grip", "Haven's".
Rittenhouse-Smith Electric Co., Smith & Hemenway Co., New York.
Scranton, Pa. (Wire Stretcher.)
Western Electric Co., New York. "Buffalo Grip".
Burr Mfg. Co., Cleveland, Ohio.
Dicke Tool Co., Downers Grove, Ill.
Eureka Tempered Copper Works, North East, Pa. "Westfield", "Parallel".
Lamson & Sessions Co., Cleveland, Ohio. "Bull Dog".
C. L. Sawyer, Miller's Falls, Mass. "Hercules" (Wire Stretcher.)
Union Electric Mfg. Co., Pekin, Ill. "Never Slip".

COMMUTATOR LUBRICANTS.
Joseph Dixon Crucible Co., Jersey City, N. J.
Le Valley Vitae Carbon Brush Co., New York. "Gold Medal".
McGill Mfg. Co., Valparaiso, Ind. "Star".
K. McLennan & Co., Chicago, Ill. "Gale's".
L. B. Allen Co., Chicago, Ill. "The Allen".
Automatic Electric Co., Chicago.
Chicago Solder Co., Chicago, Ill.
Como Electrical Co., Spring Lake, N. J. "Hinckley's Hiko".
Corliss Chemical Co., St. Louis, Mo.
Crown Woven Wire Brush Co., Salem, Mass.
James Goldmark Co., New York. "Trotter's".
International Acheson Graphite Co., Niagara Falls, N. Y.
Mortimer Du Perow Electric Co., Washington, D. C. "Deco".
G. W. Fowler & Co., North Tonawanda, N. Y. "Niagara".
Hart & Co., Fostoria, Ohio. "Red Cross".
Onward Mfg. Co., Menasha, Wis.
J. F. Walsh Co., Pittsfield, Mass. "Anti-Spark."
Warren Lubricant Co., Buffalo, N. Y. "Perfecto", "Sanderson", "Spermo", "Consistency".

COMMUTATOR REPAIR CEMENT.
E. E. Early Co., Canton, Ohio.
Plas-Mica Co., Yonkers, N. Y.

COMMUTATOR BARS & SEGMENTS.
General Electric Co., Schenectady.
Billings & Spencer Co., Hartford, Conn.
Cameron Electrical Mfg. Co., Ansonia, Conn.
Eureka Tempered Copper Works, North East, Pa.

COMMUTATOR TRUING DEVICES.
Fort Wayne Electric Works, Fort Wayne, Ind.
Jordan Bros., New York, N. Y.

COMMUTATORS.
American General Trading Co., New York. "A. G. E."
A. B. Black Road Machinery Co., Boston, Mass. "Climax".
Cameron Electrical Mfg. Co., Ansonia, Conn.
James H. Cary, Portland, Me.
Cleveland Armature Works, Cleveland, Ohio.
Columbia Machine Works & Malleable Iron Co., Brooklyn, N. Y.
Doubleday-Hill Elec. Co., Pittsburg, Pa.
Eureka Tempered Copper Works, North East, Pa.
Forsyth Electric Co., Seattle, Wash.
Homer Commutator Co., Cleveland, Ohio.
F. H. Lovell & Co., Arlington, N. J. (Automobile.)
Frank Ridlon Co., Boston, Mass.
S. J. Stewart, New Orleans, La.

COMPOSITION. See Insulation, also Line Material.

COMPOUNDS, Boiler Cleansing.
Dearborn Chemical Co., Chicago.
H. W. Johns-Manville Co. New York, N. Y.
Bird-Archer Co., New York. (Boiler Compound.)
Corliss Chemical Co., St. Louis, Mo.
Hawkeye Compound Co., Chicago. (Boiler Compound.)

COMPOUNDS, Commutator.
See Commutator Lubricants.

COMPOUNDS, Impregnating.
See Varnish.

COMPOUNDS, Insulating.
See Insulating Paints.

COMPOUNDS, Splicing.
See Tape.

COMPRESSORS, Air.
See Air Compressors.
(For small sizes, see Brushes, Pneumatic.)

CONDENSERS, Electric.
Leeds & Northrup Co., Philadelphia, Pa.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Automatic Electric Co., Chicago, "Raven" brand. Iowa.
Electric Specialty Co., Cresco, Ericsson Mfg. Co., Buffalo, N. Y.
Marconi Wireless Telegraph Co., New York, N. Y.
Wm. Marshall, New York, N. Y.
Queen-Gray Co. Philadelphia, Pa.
Storm, Francis, New York. (Copper plated.)
Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

CONDENSERS, Steam.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Westinghouse Mach. Co., Pittsburgh, Pa.

CONDUCTORS, Armored.
See Cables.

CONDUIT, Flexible.
American Conduit Mfg. Co., Pittsburgh, Pa. "Wireduct" Flexible Non-Metallic.
Central Electric Co., Chicago, Ill.
National Metal Molding Co., Pittsburgh, Pa. "Flexsteel" (Metallic). "Flexduct" (Non-metallic).
Sprague Electric Works, New York. "Greenfieldduct" Flexible Metallic.
Tubular Woven Fabric Co., Pawtucket, R. I.
T. R. Almond Mfg. Co., Ashburnham, Mass.
Alphaduct Co., Jersey City, N. J. ("Alphaduct" Flexible Non-Metallic.)
American Circular Loom Co., Boston, Mass. ("Circular Loom" Flexible. Galvanized.)
American Metal Hose Co., New York.
Conduit & Cable Mfg. Co., Chelsea, Mass. "Wovenconduit".
Eastern Flexible Conduit Co., Brooklyn, N. Y. ("Brookduct" Non-Metallic Flexible.)
Flexible Conduit Co., Penn Yan, N. Y. "Braiduct".
Greenfield Conduit Mfg. Co., Jersey City, N. J.
C. S. Knowles, Boston.
Lombardi Motor Co., Derby, Conn.
Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa.
Safety Armorite Conduit Co., Pittsburgh, Pa. "Sterling".
Saylor Electric Co., Pittsburgh, Pa. ("Safeduct" Flexible.)

CONDUIT, Interior (Rigid).
American Conduit Mfg. Co., Pittsburgh, Pa. "Galvanite" and "American."
Central Electric Co., Chicago, Ill.
Enameled Metals Co., Pittsburgh, Pa. ("Pittsburgh Standard".)
National Metal Molding Co., Pittsburgh, Pa. "Sherardduct" "Economy".
Sprague Electric Wks., New York. "Greenfielduct" Rigid.
Central Tube Co., Pittsburgh, Pa.
Clifton Mfg. Co., Jamaica Plain, Mass.
C. S. Knowles, Boston, Mass. "Enamelduct", "Alumaduct".
Mark Mfg. Co., Evanston, Ill. ("Navalite" Rigid.)
Pittsburg Conduit Co., Pittsburgh, Pa. ("Alumaduct" and "Armaduct" Rigid.)
Safety Armorite Conduit Co., Pittsburgh, Pa. "Loricated", "Armaduct", "Galvaduct".
Western Conduit Co., Youngstown, Ohio. "Buckeye."

CONDUIT, Underground, Clay, Composition, Fibre, Wood.
American Cross Arm Co., Chicago, Ill. (Creosoted Wood.)
H. B. Camp Co., New York, "Camp-Duct".
H. W. Johns-Manville Co., New York. ("J. M." Fibre.)
McRoy Clay Works, Chicago.
American Conduit Co., East Chicago, Ind. (Bitumenized Fibre.)
American Sewer Pipe Co., Akron, Ohio.
American Vitrified Conduit Co., New York.
Brazil Hollow Brick & Tile Co., Brazil, Ind.
Chicago Stone Conduit Co., Chicago, Ill. "Stoneduct."
Clay Product Co., Chicago, Ill.
Clermont Sewer Pipe Co., New York.
Denny-Renton Clay & Coal Co., Seattle, Wash.
W. S. Dickey Clay Mfg. Co., Kansas City, Mo.
Dielectric Co. of America, Belleville, N. J.
Evans, Almiral Co., Chicago.
Fibre Conduit Co., Orangeburg, N. Y.
Grand Ledge Clay Products Co., Grand Ledge, Mich.
Great Eastern Clay Products Co., South River, N. J.
Michigan Pipe Co., Bay City, Mich. (Wood.)
Monolithic Conduit Co., St. Louis, Mo.
N. Y. State Sewer Pipe Co., Rochester, N. Y.
Norfolk Creosoting Co., Norfolk, Va. (Creosoted Wood.)
Rochester Sewer Pipe Co., Rochester, N. Y.
Standard Sewer Pipe Co., Rochester, N. Y.
Standard Vitrified Conduit Co., New York.
Wyckoff Pipe & Creosoting Co., New York. (Creosoted Wood.)

CONDUIT BENDERS.
See Benders.

CONDUIT ENGINEERS & CONTRACTORS.
G. M. Gest, New York, N. Y.
Graner-Mahoney Contracting Co., St. Louis, Mo.
J. W. Turner Improvement Co., Des Moines, Iowa.

CONDUIT FISHING MACHINES.
See Fishing Machines.

CONDUIT RODS.
(And Couplings for same.)
F. Bissell Co., Toledo, O. "Security".
Standard Underground Cable Co., Pittsburgh, Pa. "Empire" Duct Rods.
Western Electric Co., New York.
Harold L. Bond Co., Boston, Mass.
Chicago Conduit Rod Coupling Co., Chicago, Ill.
Cleverly Elec. Works, Philadelphia, Pa.
T. J. Cope, Philadelphia, Pa.
Diamond Expansion Bolt Co., New York. "Empire".
Kinsey Mfg. Co., Toledo, Ohio.
Meckel, Fred L., Chicago, Ill.

CONNECTORS, Automobile Wire.
General Electric Co., Schenectady, N. Y.
J. Alexander Co., New York.
Chicago Electric Mfg. Co., Chicago, Ill. "Handy".
Culver-Stearns Mfg. Co., Worcester, Mass.
Frank W. Morse, Boston, Mass.

CONNECTORS, Battery.
Belden Mfg. Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York. "Sta-There," "Mesco".
National Carbon Co., Cleveland, Ohio.
America Ever Ready Co., New York. "Bull Dog"
Atlas Mfg. Co., New Haven, Conn.
Barcy-Nicholson Co., Detroit, Mich.
Beck Co., Rockville Centre, N. Y.
Bliss-Chester Co., Providence, R. I. "Duplex".
Geo. W. Bolton & Co., Detroit, Mich. "Perfecto." "Simplex".
W. Wood Carlisle, Buffalo, N. Y. "Ever Best".
Delta-Star Electric Co., Chicago.
Harvard Electric Co., Chicago, Ill
Knoblock-Heideman Mfg. Co., South Bend, Ind. "Quick Action".
Lemke Electric Co., Milwaukee, Wis. "L. B."
Lombardi Motor Co., Derby, Conn.
O. K. Connector Co., Worcester, Mass.
Oliver Electric & Mfg. Co., St. Louis, Mo.
Stackpole Carbon Co., St. Marys, Pa. "Mills".
Tregoning Electric Mfg. Co., Cleveland, Ohio. "Lobster Claw".

CONNECTORS, Box and Cabinet.
Appleton Electric Co., Chicago, Ill. "No-Thread".
Sprague Electric Works, New York.
Thomas & Betts Co., New York. "T. & B."
W. A. Bonnell Co., New York.
Wm. S. Brown Electric Co., New York.
Standard Electric Fittings Co., Stamford, Conn.

CONNECTORS, Copper Wire, Splicing.
Appleton Electric Co., Chicago.
Badt-Westburg Electric Co., Chicago.
Belden Mfg. Co., Chicago, Ill.
Chicago Fuse Mfg. Co., Chicago.
Dossert & Co., New York. (Solderless.)
Electric Controller & Mfg. Co., Cleveland, O.
Electrical Engineers Equipment Co., Chicago, Ill. (T-Split.)
Fairmount Electric & Mfg. Co., Philadelphia, Pa. "Alligator". "H. W. W."
Hickey & Schneider, New York, N. Y.
Manhattan Electrical Supply Co., New York.
W. R. Ostrander & Co., New York.
Trumbull Electric Mfg. Co., Plainville, Conn.
Automatic Electric Co., Chicago.
Bryant Zinc Co., Chicago, Ill. ("Premier" Sleeve.)
J. H. Bunnell & Co., New York.
Chicago Die & Machine Works, Chicago, Ill. ("Maxstadtt" Sleeve.)
Chicago Nut Co., Chicago, Ill.
Clark Electric & Mfg. Co., New York. (Sleeve.)
Frank B. Cook, Chicago, Ill.
Fort Dearborn Mfg. Co., Chicago, Ill. "Zeno".
Harvard Electric Co., Chicago, Ill. (Sleeve.)
Holtzer-Cabot Electric Co., Brookline, Mass.
H. Krantz Mfg. Co., Brooklyn, N. Y. (Sleeve.)
C. McIntyre Co., Newark, N. J.
Frank W. Morse, Boston, Mass. "Eureka".
Nagel-Collins Mfg. Co., Chicago, Ill.
National Electric Specialty Co., Toledo, Ohio. ("Ritetite" Self Soldering.)
National Telephone Supply Co., Cleveland, Ohio (Sleeve.)
P. & M. Co., Chicago, Ill.
Philadelphia Electric Mfg. Co., Philadelphia, Pa.
Pringle Electrical Mfg. Co., Philadelphia, Pa.
Reliable Electric Co., Chicago, Ill. (Sleeve.)
Frank Ridlon Co., Boston, Mass.
Sibley & Pitman, New York. "Climax."
John J. Waldman, New York, N. Y.
Waterbury Mfg. Co., Waterbury, Conn.
Yonkers Specialty Co., Yonkers, N. Y. "New York".

CONNECTORS, Stage.
Universal Electric Stage Lighting Co., New York. "Kliegl Bros."
Chicago Electric Fittings Co.,
Chicago Electric Mfg. Co., Chicago.

CONSTRUCTION, Engineering.
Arnold Co., The, Chicago, Ill.
Byllesby & Co., H. M., Chicago, Ill.
Central Station Engineering Co., Chicago, Ill.
Ford, Bacon & Davis, New York.
New England Engineering Co., New York, N. Y.
Stone & Webster Eng. Corp., Boston, Mass.
White Companies, J. G., New York, N. Y.
Woodmansee & Davidson, Inc., Chicago.

CONTROLLERS, Current.
(See Rheostats; Controllers, Printing Press, Auto-Starters.)

CONTROLLERS, Flat Rate.
Excess Indicator Co., Pittsburgh.
Henry Thermo-Electric Co., Newport, Vt.

CONTROLLERS, Printing Press.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

Crocker-Wheeler Co., Ampere, N. J.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Monitor Controller Co., Baltimore, Md.
Union Electric Mfg. Co., Milwaukee, Wis.

CONTROLLER, Regulators. See Rheostats, Motor Controlling.

CONVERTERS. See Rectifiers.

CONVEYORS, Coal.
Aultman Co., Canton, Ohio.
C. O. Bartlett & Snow Co., Cleveland, Ohio.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Buhl Malleable Co., Detroit, Mich.
Darley Engineering Co., New York ("Suction" Ashes conveyor.)
Exeter Machine Works, Pittston, Pa. "Le Grand".
M. Garland Co., Bay City, Mich.
C. W. Hunt Co., West New Brighton, N. Y. "Noiseless Gravity".
Interstate Engineering Co., Cleveland, Ohio.
Jeffrey Mfg. Co., Columbus, Ohio.
Link-Belt Co., Philadelphia, Pa. "Peck"
Mead-Morrison Mfg. Co., Cambridge, Mass. "McCaslin", "Harrison's".
Minneapolis Steel & Machinery Co., Minneapolis, Minn.
Robins Conveying Belt Co., New York.
P. H. & F. M. Roots, Connersville, Ind.
Skillin & Richards Mfg. Co., Chicago, Ill.
Steel Cable Engineering Co., Everett, Mass.
Webster Mfg. Co., Chicago, Ill.

COOKERS, Fireless Electric.
Phelps Mfg. Co., Detroit, Mich.
Automatic Electric Cook Co., Toronto, Ont., Fireless Cookers.
Cadillac Electric Mfg. Co., Cadillac, Mich.
Comet Electric Stove Co., Detroit, Mich.
Detroit Fireless Stove Co., Detroit, Mich.
Electric Fireless Cookstove Co., Buchanan, Mich. ("Favorite", "Ideal" and "Model".)
A. L. Sykes Mfg. Co., Cincinnati, Ohio. "Quad" Fireless Cookers.

COOKING DEVICES, Electric.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Diamond Electric Co., Binghamton, N. Y.
Federal Sign System (Electric), Chicago, Ill. (Kitchen Cabinets.)
General Electric Co., Schenectady, N. Y.
Hellon Electric Co., Newark, N. J.
Manhattan Electrical Supply Co., New York.
Phelps Mfg. Co., Detroit, Mich. ("Cozy" Toaster.)
Simplex Electric Heating Co., Cambridge, Mass.
Western Electric Co., New York.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
American Electrical Heater Co., Detroit, Mich.
Cadillac Electric Mfg. Co., Cadillac, Mich.
Comet Electric Stove Co., Detroit, Mich.
Copeman Electric Stove Co., Flint, Mich.
Pelouze Mfg. Co., Chicago.
Despatch Mfg. Co., Minneapolis, Minn. Electric Ovens.
Detroit Fireless Stove Co., Detroit, Mich.
Hoskins Mfg. Co., Detroit, Mich. (Toasters.)
Hot Point Electric Heating Co., Ontario, Calif. ("El Tosto" Toaster, "Utility Hot Point" Sad Irons.)
Hughes Electric Heating Co., Chicago, Ill. (Cook Stove.)
International Instrument Co., Cambridge, Mass. (Electric Ovens.)
Multiple Unit Electric Co., New York. (Electric Ovens.)
Albert Pick & Co., Chicago. (Cooking Ranges.)
Sternau & Co., Brooklyn, N. Y.
A. L. Sykes Mfg. Co., Cincinnati, Ohio. ("Quad" Cooker.)
Thermo Mfg. Co., Cleveland, Ohio. (Fireless Cooker and Oven.)

COPPERS, Battery.
Manhattan Electric Supply Co., New York, N. Y.
Stanley & Patterson, New York. "Greeley".
Western Electric Co., New York.
Beattie Zinc Works Co., Reading, Mass.
Bryant Zinc Co., Chicago, Ill.
Edes Mfg. Co., Plymouth, Mass.
John M. Fox & Co., Portland, Me.
Grasselli Chemical Co., Cleveland, Ohio.

CORD ADJUSTERS. See Adjusters.

CORD, Braided, Arc Lamp Ropes, Arc Lamp Chain.
Samson Cordage Works, Boston, Mass.
J. E. Fricke & Co., Philadelphia, Pa. "Jefferson".
International Register Co., Chicago, Ill.
Oneida Community, Oneida, N. Y. (Chain Only.)
Silver Lake Co., Boston, Mass.

CORD, Flexible. See Wire, Rubber Covered.

CORD, Telephone (Flexible).
American Electrical Works, Phillipsdale, R. I.
Belden Mfg. Co., Chicago, Ill.
Driver-Harris Wire Co., Harrison, N. J.
Kellogg Switchboard & Supply Co., Chicago, Ill.
Alfred F. Moore, Philadelphia, Pa.
Western Electric Co., New York.
Chicago Insulated Wire & Mfg. Co., Chicago.
C. H. McEvoy, Lowell, Mass. "Duro".
Premier Electric Co., Chicago.
Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.
Runzel-Lenz Elec. Co., Chicago.

COTTON (Insulating). See Yarn.

COUNTERS, Pole.
Benton Mfg. Co., New York.
W. N. Durant Co., Milwaukee, Wis.
International Register Co., Chicago, Ill.
New York Standard Watch Works, Jersey City, N. J.
Schaeffer & Rudenberg Mfg. Co., Brooklyn, N. Y.
Standard Register Co., Chicago, Ill. "Pratts".

COUNTERS, Revolution.
Belden Mfg. Co., Chicago, Ill.
Bristol Company, Waterbury, Conn.
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Ashcroft Mfg. Co., New York.
Ashton Valve Co., Boston, Mass.
S. M. Balzer, New York. "Vernon".
Campbell Printing Press & Mfg. Co., New York. "Hawkins".
Crosby Steam Gage & Valve Co., Boston, Mass.
W. N. Durant Co., Milwaukee, Wis.
Esterline Co., Lafayette, Ind. (Electric.)
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Green, Tweed & Co., New York. "Empire". "Weiss".
Industrial Instrument Co., Foxboro, Mass.
J. E. Lonergan & Co., Philadelphia, Pa.
Maritime Instrument Co., Boston, Mass.
James P. Marsh & Co., Chicago.
National Gauge Co., Brooklyn, N. Y.
National Steam Specialty Co., Chicago, Ill.
Niagara Tachometer and Instrument Co., Niagara Falls, N. Y.
C. J. Root Co., Bristol, Conn. "Bristol", "Elm City".
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Schuchardt & Schutte, New York. (Importers "S. & S.", "Lindstrom".)
Star Brass Mfg. Co., Boston, Mass.
L. S. Starrett & Co., Athol, Mass.
Syracuse Steam Gauge Mfg. Co., Syracuse, N. Y. "Syracuse".
Uehling Instrument Co., Passaic, N. J.
Utica Steam Gauge Co., New York.
Veeder Mfg. Co., Hartford, Conn.
Warner Instrument Co., Beloit, Wis.
R. Woodman Mfg. & Supply Co., Boston, Mass.
A. Zaubitz, New York.

COUPLINGS AND NIPPLES, Conduit.
American Conduit Mfg. Co., Pittsburgh, Pa. (Couplings.)
Appleton Electric Co., Chicago, Ill. ("No-Thread" Couplings.)
Enameled Metals Co., Pittsburgh, Pa. (Couplings.)
National Metal Molding Co., Pittsburgh, Pa. (Couplings.)
Thomas & Betts Co., New York. "T. & B." (Erickson Couplings.)
American Circular Loom Co., Boston, Mass. (Couplings.)
W. A. Bonnell Co., New York.
Condit Electrical Mfg. Co., Boston, Mass. ("Chase" Nipples and "Shawmut" Couplings.)
K. & B. Co., Philadelphia, Pa. ("Ready Thread" Couplings.)
Safety-Armorite Conduit Co., Pittsburgh, Pa. "Ready Thread" Couplings.

COUPLINGS, Shaft, Insulated.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Chas. Bond Co., Philadelphia, Pa. "Grundy".

COVERING MACHINES, Wire.
Minneapolis Electric & Construction Co., Minneapolis, Minn.
New England Butt Co., Providence, R. I.
American Insulating Machinery Co., Philadelphia, Pa.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Harvard Electric Co., Chicago, Ill.
Rhode Island Braiding Machine Co., Providence, R. I.
C. J. Root Co., Bristol, Conn. "Roco".
John Royle & Sons, Paterson, N. J.
Textile Machine Works, Reading, Pa.
Universal Winding Co., Boston, Mass.
John J. Waldman, New York. "Jones-Perfection".

COVERS AND GUARDS, Manhole.
F. Bissell Co., Toledo, O. "Security".
Davenport Machine & Foundry Co., Davenport, Ia.
Wallace Foundry & Mach. Co., Lafayette, Ind.

COW MILKERS.
See Dairy Apparatus.

CRANES AND HOISTS.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Jordan Bros., New York. (Differential Grip Hoists.)
Sprague Electric Works, New York.
American Engineering Co., Philadelphia, Pa.
American Hoist & Derrick Co., St. Paul, Minn.
American Ship Windlass Co., Providence, R. I.
Alfred Box & Co., Philadelphia.
Brown Hoisting Machinery Co., Cleveland, Ohio.
Browning Engineering Co., Cleveland, Ohio.
Butte Engineering & Electric Co., San Francisco, Calif.
Thos. Carlin's Sons Co., Pittsburgh, Pa. (Hoists.)
Case-Crane Co., Columbus, Ohio.
Chambersburg Engineering Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., Chicago, Ill.
Chisholm & Moore Mfg. Co., Cleveland, Ohio. "Cyclone".
Cleveland Crane & Car Co., Wickliffe, Ohio. (Monorail.)
Climax Hoist Co., Philadelphia.
Curtis & Co., Mfg. Co., St. Louis
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
Economy Engineering Co., Chicago, Ill. (Electric Tiering Machines.)
Elevator Supply & Repair Co., Chicago. (Scene and Curtain Hoists.)
S. Flory Mfg. Co., Bangor, Pa.
Fairbanks-Morse & Co., Chicago.
Franklin Portable Crane & Hoist Co., Franklin, Pa.
Edwin Harrington, Son & Co., Philadelphia, Pa.
Humphrey & Son, Joliet, Ill.
C. W. Hunt Co., West New Brighton, N. Y.
Industrial Works, Bay City, Mich.
Interstate Engineering Co., Cleveland, Ohio.
King Bridge Co., Cleveland.
Lidgerwood Mfg. Co., New York. (Hoists.)
Maine Electric Co., Portland, Me.
Maris Bros., Philadelphia, Pa.
Mead-Morrison Mfg. Co., Cambridge, Mass.
Morgan Engineering Co., Alliance, Ohio.
Northern Engineering Works, Detroit, Mich.
Otis Elevator Co., New York.
Patten Mfg. Co., Chattanooga.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Reading Crane & Hoist Works, Reading, Pa.
James H. Roberts Elevator Co., New York.
Seelar Elevator Works, Pittsburgh, Pa.
Sellers & Co., Wm., Philadelphia, Pa.
Shaw Electric Crane Co., New York.
Sheppard Electric Crane & Hoist Co., Montour Falls, N. Y.
Chas. A. Strelinger Co., Detroit, Mich.
Thomas Elevator Co. Works, Chicago, Ill.
Wellman-Seaver-Morgan Co., Cleveland, Ohio.
Whiting Foundry Equipment Co., Harvey, Ill.
Willamette Iron & Steel Works, Portland, Ore. (Electric Hoists.)
Williamson Bros. Co., Philadelphia, Pa. (Warping and Hauling Hoists.)
Yale & Towne Mfg. Co., New York.

CRANE MOTORS.
Crocker-Wheeler Co., Ampere, N. J.
Ft. Wayne Electric Works, Fort Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Mechanical Appliance Co., Milwaukee, Wis.
Triumph Electric Co., Cincinnati, O.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

CREOSOTED PRODUCTS.
American Cross Arm Co., Chicago.
Valentine-Clark Co., Minneapolis, Minn.

CROOKES TUBES. See X-Ray Outfits

CROSS ARMS. (Wood.)
American Bridge Co., New York.
American Cross Arm Co., Chicago, Ill.
F. Bissell Co., Toledo, Ohio.
Lindsley Bros. Co., Spokane, Wash.
Wm. Mueller & Co., Chicago.
W. M. Ansher Co., North Wilkesboro, N. C.
Berlin Mills Co., Portland, Me (Kyanized Spruce.)
Berthold & Jennings Lumber Co., St. Louis, Mo.
Boggs & McNeill Co., Albany, Ga.
Central Mfg. Co., Chattanooga, Tenn.
Cohn & Bock Co., Princess Anne, Md.
John A. Cranston Lumber Co., Wilmington, Del.
Doty Lumber & Shingle Co., Doty, Wash.
Elkin Machinery Co., Elkin, N. C.
Ferguson Lumber Co., Little Rock, Ark.
Gulf Arm & Creosoting Co., Hattiesburg, Miss.
Kettle River Co., Minneapolis, Minn.
Louisiana Red Cypress Co., New Orleans, La.
W. S. Morse Lumber Co., Los Angeles, Calif.
Norfolk Creosoting Co., Norfolk, Va.
John L. Roper Lumber Co., Norfolk, Va.
Southern Exchange Co., New York, N. Y.
Southern Pine Mfg. Co., Paducah, Ky.
J. B. Voncanon, West End, N. C.
A. S. Wade & Co., Shippensburg, Pa.
Western Lumber & Pole Co., Denver, Colo.
F. B. Williams Cypress Co., Patterson, La.
Wyckoff Pine & Creosoting Co., New York.

CROSS ARM BRACES. See Braces.

CROSS ARM SUPPORTS. See Supports.

CROWFEET. See Fittings, Fixture.

CRYSTALS, Chandelier, Prisms, Beads.
Franz Euler & Co., New York, N. Y. (Importers.)
Fensterer & Ruhe, New York.
Oscar O. Friedlaender, New York.

Noe & Sons, Wm. R., New York, N. Y.
Pairpont Corp., New Bedford, Mass.
Schaffer-Fiaum Co., New York.
Siegman & Weil, New York.
Alfred Wolff & Co., New York. (Importers.)

CUPS, Porous.
Fidelity Pottery Co., Trenton, N. J.
John Maddock & Sons, Trenton, N. J.
Marion Pottery Works, Jersey City, N. J.
New England Pottery Co., Boston, Mass.
Robinson Clay Product Co., New York.

CURLING IRONS, Electric (and heaters for curling irons.)
Manhattan Electrical Supply Co., New York.
Simplex Electric Heating Co., Cambridge, Mass.
M. M. Buck, Franklinville, N. Y. "Her Majesty" (Coin in slot Curling Iron).
J. L. Burgard, Chicago, Ill. ("Bolin" Curling Irons.)
Cassady-Fairbank Mfg. Co., Chicago, Ill. (Curling Iron and Thermo Socket.)
Pelouze Mfg. Co., Chicago.
Vulcan Electric Heating Co., Buffalo, N. Y.

CUSHIONS, Field Coil.
W. N. Matthews & Bro., St. Louis, Mo.
Mass Chemical Co., Walpole, Mass.

CUT-OUTS, Enclosed Fuse, Plug, Rosette, Cut-Out Bases.
Arrow Electric Co., Hartford, Conn.
Borden Co., Warren, Ohio.
Central Electric Co., Chicago.
Chicago Fuse Mfg. Co., Chicago, Ill. "Union" fuse blocks and entrance service cut-outs.
Commonwealth Edison Co., Chicago, Ill.
D & W Fuse Co., Providence, R. I.
Detroit Fuse & Mfg. Co., Detroit Mich.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Hickey & Schneider, New York.
H. W. Johns-Manville Co., New York.
Manhattan Electrical Supply Co., New York. "Mesco".
National Metal Molding Co., Pittsburgh, Pa.
H. T. Paiste Co., Philadelphia, Pa. "P. K." "K. W."
Pass & Seymour, Inc., Solvay, N. Y. "Little Gem".
Trumbull Elec. Mfg. Co., Plainville, Conn.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Atlantic Electric Goods Co., New York. ("Stewart" Rosettes.)
Bryant Electric Co., Bridgeport, Conn. "K. W."
Chase-Shawmut Co., Newburyport, Mass.
Conn. Elec. Mfg. Co., Bridgeport, Conn.
Electrical Mfg. Co., Oshkosh, Wis. "M. & R."
Empire Electric Mfg. Co., Plainville, Conn.
E. H. Freeman Electric Co., Trenton, N. J.
Gilmore Electric Co., South Boston, Mass.
Geo. Heinemann & Co., Philadelphia Pa.
Jas. S. Johnston Mfg. Co., Utica, N. Y.
C. S. Knowles, Boston, Mass. ("Moffett" and "K. P." Fuseless Rosettes.)
W. N. Matthews & Bro., St. Louis.
New Haven Electric Mfg. Co., North Haven, Conn.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn. "Thomas".
Peru Elec. Mfg. Co., Peru, Ind.
Sachs Co., Hartford, Conn.
Shedd Electric Co., Roselle Park, N. J.
Tregoning Electric Mfg. Co., Cleveland, Ohio. (Rosettes.)
Weber Electric Co. (Henry D. Sears, General Sales Agent, Boston, Mass.)
Worcester Electric Mfg. Co., Worcester, Mass.

CUT-OUTS, Arc Light.
Brady Electric Mfg. Co., New Britain, Conn.
Geo. Cutter Co., South Bend, Ind.
Fort Wayne Electric Works, Ft. Wayne, Ind. "Wood".
General Electric Co., Schenectady, N. Y.
High Tension Electrical Specialty Co., Newton, Mass.
Bryant Electric Co., Bridgeport, Conn. "Bryant-Cleveland".
Lundin Electric & Machine Co., Boston, Mass.
Philadelphia Electric Mfg. Co., Philadelphia, Pa.

CUT-OUTS, Transformer.
Central Electric Co., Chicago, Ill.
D & W Fuse Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
Pass & Seymour, Inc., Solvay, N. Y.
Pittsburgh Transformer Co., Pittsburgh, Pa.
Wagner Electric Mfg. Co., St. Louis.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Delta-Star Electric Co., Chicago, (High Voltage.)
C. S. Knowles, Boston, Mass.
Philadelphia Electric Mfg. Co., Philadelphia, Pa.

CUTTERS, Carbon and Porcelain.
Hagstrom Bros. Mfg. Co., Lindsborg, Kans.
Lundin Elec. & Mach. Co., Boston, Mass.

CUTTERS, Cloth. (Motor Driven.)
American Electric Mach. Co., New York, "Waring".
Eastman Machine Co., Buffalo, N. Y.
Universal Cutter Co., St. Louis, Mo.
Wildman Mfg. Co., Norristown, Pa. "Ballard", "Hemafan".
Wolf Electrical Promoting Co., Cincinnati, Ohio. "Star", "Cyclone", "Bloch-Wolf".
C. E. Wright Co., Kenilworth, N. J.

CUTTERS, Pipe.
Borden Co., Warren, Ohio.

DAIRY APPARATUS (Electric).
Mechanical Appliance Co., Milwaukee, Wis.
American Butter Cutting Machine Co., New York
D. H. Burrell & Co., Little Falls, N. Y. ("Simplex" Milk Testers, Churns and Butter Makers and Cow Milkers.)
Creamery Package Mfg. Co., Chicago, Ill. (Milk Testers.)
Esterline Co., Lafayette, Ind. (Milk Testers.)
International Instrument Co., Cambridge, Mass.
John E. Low, Chicago. (Butter Cutters.)
Liberty Cow Milker Co., Hammond, Ind.
Sylvan, A. E., New York.
Wels Mfg. & Supply Co., Hammond, Ind (Cow Milkers.)

DAMS, Movable.
American Bridge Co., New York.

DECORATIVE LIGHTING.
Central Electric Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y. (Christmas Tree Lighting Outfits.)
Manhattan Electrical Supply Co., New York. (Decorative Outfit.)
National Quality Lamp Division of General Electric Co.—The following member works:
Elux Miniature Lamp Works, New York.
P R Mfg. Co., Detroit, Mich.
American Miniature & Decorative Lamp Co., New York.
Botanical Decorating Co., Chicago, Ill.
Elblight Co., of America, N. Y.
Electric Mfg. Co., Baltimore, Md. (Christmas Tree Lighting Outfits.)
Franco-American Electric Novelty Co., New York. (Christmas Tree Lighting Outfits.)
Gudeman & Co., New York, N. Y. (Flower Baskets, Christmas Tree Lighting Outfits.)
Industrial Novelty Co., Chicago, Ill. (Importers.)
H. W. McCandless & Co., New York. (Christmas Tree Lighting Outfits.)
Standard Electric Novelty Co., Chicago, Ill. (Christmas Tree.)
Tardie, E. J., New York.
Tietgen, Falk & Co., Chicago, Ill.
Union Battery Co., Belleville, N. J. (Christmas Tree Battery Lighting Outfits.)
Alfred Wolff & Co., New York.

DEFLECTORS, Fan.
James Goldmark Co., New York. "Simplex"

DEMAGNETIZERS, Watch.
Boettger & Wittig, Milwaukee, Wis.
W. Green Elec. Co., New York.
Knoblock-Heideman Mfg. Co., South Bend, Ind. "South Bend."

DENTAL APPLIANCES.
See Medical Apparatus.

DERRICKS.
American Bridge Co., New York.

DESK FANS.
See Fans, Portable.

DESK LAMPS.
See Lights, Desk.

DETECTORS, Ground. See Instruments, Testing.
DEUPODS. See Fittings, Fixture.
DIES. See Pipe Fitting Tools.
DIE STOCKS.
Borden Co., Warren, Ohio.
DIMMERS. (See Rheostats, Stage Dimming. Also Sockets Regulating.

DIRECT MOTOR DRIVES for Planers, Etc.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Electric Controller & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady, N. Y.
Mechanical Appliance Co., Milwaukee, Wis.
Triumph Electric Co., Cincinnati, Ohio.
Western Electric Co., New York, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

DISCS, Armature. Iron Discs and Segments for Armatures and Transformers.
Edward E. Cary Co., New York. "Sankey."
Thomas Smith Co., Worcester, Mass.
W. & S. Mfg. Co., Worcester, Mass.

DISCONNECTORS.
See Switches, Disconnecting.

DISTRICT CALL BOXES. See Fire Alarms.
DOMES. See Shades, glass.

DOOR OPENERS & LOCKS.
Manhattan Electrical Supply Co., New York.
Warren E. Clark, Dorchester, Mass. ("P. & T." Electric Lock.)
Edwards & Co., New York.
Francis Keil & Sons, New York. "Reliance, Jr." "Reliance."
M. Mueller, Boston, Mass.
Standard Lock Co., Brooklyn, N. Y. "Champion," "Bull Dog."

DOOR SWITCHES, Automatic. (Operating lights by opening and closing the door.)
Arrow Electric Co., Hartford, Conn. "Arrow E."
Cutler-Hammer Mfg. Co., Milwaukee, Wis. "C. H."
Cutter Co., Philadelphia, Pa. "Daisy."
Hart Mfg. Co., Hartford, Conn. "Diamond H."
Edwards & Co., New York. "Lungen". "Eco".
Hart & Hegeman Mfg. Co., Hartford, Conn. "H. & H."
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
A. Sechrist Mfg. Co., Denver, Colo.

DRESSING, Commutator. See Commutator Lubricants

DRIERS AND IMPREGNATORS. Armature, Field Coil.
Buffalo Foundry & Machine Co., Buffalo, N. Y.
J. P. Devine Co., Buffalo, N. Y. "Passburg."
N. Hubbard's Sons, Brooklyn.
F. J. Stokes Mach. Co., Philadelphia, Pa.

DRILLS AND BITS. Electricians.
Hubbard & Co., Pittsburgh, Pa. "Pierce Hammer Drill."
Kyle, W. H., Akron, Ohio.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Smith & Hemenway Co., New York.
Cincinnati Tool Co., Cincinnati, Ohio. "Hargrave".
Cleveland Twist Drill Co., Cleveland, Ohio.
Daugherty, Smith, Phillips Co., Chicago.
Detroit Twist Drill Co., Detroit, Mich.
Dicke Tool Co., Downers Grove, Ill.
J. F. McCoy Co., New York, N. Y. "Osborne" Hollow Drill.
H. H. Mayhew Co., Shelbourne Falls, Mass.
Standard Tool Co., Cleveland, Ohio. (For Brick and Stone.)
Star Expansion Bolt Co., New York. ("Sebco" Hollow Drills for Brick & Stone.)
Syracuse Twist Drill Co., Syracuse, N. Y.

DRILLS, Mining.
Fort Wayne Electric Works, Fort Wayne, Ind.
Ingersoll Rand Co., New York.

DRILLS, Portable. See Tools, Portable.

DRIVERS, Staple. See Staples.

DUMBWAITERS, Electric.
Burdett-Rowntree Mfg. Co., Chicago.
Geo. T. McLaughlin Co., Boston, Mass.
Otis Elevator Co., New York.

DUSTERS, Pneumatic Armature. (See Brushes, Pneumatic.)

DYNAMOMETERS. See Instruments, Testing.
DYNAMOS. See Motors and Dynamos.

ECONOMIZERS, Tungsten Lamp. See Transformers Low Voltage.
ELECTRIC VEHICLES. See Automobiles, Electric.

ELECTRODES, Furnace.
National Carbon Co., Cleveland, O.
Hill-Morgan Electric Welding Machine Co., New York.
International Acheson Graphite Co., Niagara Falls, N. Y.

ELECTRO MAGNETS. See Magnets.

ELECTRO-PLATING MACHINERY.
Crocker-Wheeler Co., Ampere, N. J.
Electric Machinery Co., Minneapolis, Minn.
Ft. Wayne Electric Wks., Ft. Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Sprague Electric Works, New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Allen Electric Co., Chicago, Ill.
Bell Electric Motor Co., New York.
Benton Electric Co., La Crosse, Wis.
W. S. Bishop, New Haven, Conn.
C. J. Bogue Electric Co., New York.
Boissier Electric Co., New York.
Burke Electric Co., Erie, Pa.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Dover Electric Mfg. Co., Canal Dover, Ohio.
Eager Electric Co., Watertown, N. Y.
Engineering Electric Mfg. Co., Stamford, Conn.
W. Green Elec. Co., New York.
Hanson & Van Winkle, Newark, N. J.
Holtzer-Cabot Electric Co., Brookline, Mass.
Ideal Electric & Mfg. Co., Mansfield, Ohio.
Jantz & Leist Electric Co., Cincinnati, Ohio.
Kendrick & Davis Co., Lebanon, N. H.
Kester Elec. Co., Terre Haute, Ind.
Lincoln Electric Co., Cleveland, Ohio.
Lovett Mfg. Co., Matawan, N. J.
Chas. L'Hommedieu & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Pan Electric Mfg. Co., St. Louis, Mo. "Chandeysson".
Phoenix Electric Co., Mansfield, Ohio.
Rochester Electric Motor Co., Rochester, N. Y.
Roth Bros. & Co., Chicago, Ill.
U. S. Electrical Mfg. Co., Los Angeles, Cal.
Victor Electric Co., Chicago, Ill.

ELECTROSCOPES. (See Instruments. Testing.)

ELEVATORS, Electric.
Albro-Clem Elevator Co., Philadelphia, Pa.
Altizer & Prince Co., Chicago.
American Elevator Co., New York.
American Machine Co., Louisville, Ky.
Atlas Machine Co., Louisville, Ky.
Cohoes Iron Foundry & Machine Co., Cohoes, N. Y.
Eastern Machinery Co., New Haven, Conn.
Edmonds Elevator Co., Cleveland, Ohio.
Erickson-Wyman Co., Seattle, Wash.
Faunt LeRoy Elevator Co., Baltimore, Md.
F. Grote Mfg. Co., Evansville, Ind.
Gurney Elevator Co., Honesdale, Pa.
Haughton Elevator & Machine Co., Toledo, Ohio.
Houser Elevator Co., Syracuse, N. Y.
Lee & Hoff Mfg. Co., St. Paul.
Marine Engine & Machine Co., New York.
Marshall Bros., Pittsburgh, Pa.
V. W. Mason & Co., Providence, R. I.
Wm. A. Miller Elevator Co., St. Louis, Mo.
Moore & Wyman Elevator & Machine Works, Boston, Mass.
New York Elevator Co., New York.
Norwood Engrg. Co., Florence, Mass.
Ohio Elevator & Machine Co., Columbus, Ohio.
Otis Elevator Co., New York.
Reedy Elevator Co., New York.

D. V. Reedy Elevator Co., Indianapolis, Ind.
H. J. Reedy Co., Cincinnati, O.
J. W. Reedy Elevator Mfg. Co., Chicago, Ill. "Twentieth Century".
James H. Roberts Elevator Co., New York. (Dumb Waiters.)
Rochester Iron Works, Rochester, Minn.
A. B. See Elec. Elevator Co., New York.
Seelar Elevator Works, Pittsburgh, Pa.
Standard Plunger Elevator Co., New York.
Sybilla Elevator and Mfg. Co., Chattanooga, Tenn.
Van Emon Elevator Co., San Francisco, Cal.
Warner Elevator Mfg. Co., Cincinnati, Ohio.
Warsaw Elevator Co., Warsaw, N. Y.
Westbrook Elevator Co., Danville, Va.
Wheeler-McDowell Elevator Co., New York.

ENGINEERS & CONTRACTORS.
American Bridge Co., New York.
Ernest J. Andrews, Chicago.
The Arnold Co., Chicago, Ill.
Badt-Westburg Electric Co., Chicago, Ill.
H. M. Byllesby & Co., Chicago.
Central Station Engineering Co., Chicago, Ill.
Cummings, W. F., Chicago, Ill.
Dixon-Smith Engineering Co., St. Louis, Mo.
Ford, Bacon & Davis, New York.
C. W. Humphrey, Chicago.
D. C. & W. B. Jackson, Chicago.
Kohler Bros., Chicago, Ill.
Lamar Lyndon, New York.
Lloyd-Thomas Co., Chicago, Ill.
McMeen & Miller, Chicago, Ill.
New England Engineering Co., New York, N. Y.
Chas. A. Pillsbury, Minneapolis.
Sargent & Lundy, Chicago, Ill.
Sessions, E. O., Chicago, Ill.
Stone & Webster Engrg. Corpn., Boston, Mass.
J. W. Turner Improvement Co., Des Moines, Iowa.
Western Electric Co., New York.
J. G. White & Co., New York, N. Y.
Woodmansee & Davidson, Inc., Chicago.

ENGINES, Gas and Gasoline.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Archer & Baldwin, New York.
Westinghouse Machine Co., Pittsburgh, Pa.
Advance Mfg. Co., Hamilton, Ohio. "Ritchie", "Hamilton".
Alamo Mfg. Co., Hillsdale, Mich. (Electric Outfit.)
Angola Engine & Foundry Co., Angola, Ind.
Badger Gas & Gasoline Engine Co., Kansas City, Kan.
Bates & Edmonds Motor Co., Lansing, Mich.
Bates Machine Co., Joliet, Ill.
Bessemer Gas Engine Co., Grove City, Pa.
Bogart Gas Power Engrg. Co., Buffalo, N. Y.
Bruce-Macbeth Engine Co., Cleveland, Ohio.
Buckeye Engine Co., Salem, O.
W. P. Callahan Co., Dayton, Ohio.
Carlisle & Finch Co., Cincinnati, Ohio. (Generating Set.)
Cook Motor Co., Delaware, Ohio.
De La Vergne Machine Co., New York. "Koerting".
Detroit Engine Works, Detroit, Mich.
Dubois Iron Works, Du Bois, Pa.
Elbridge Engine Co., Rochester, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Fairbanks Co., New York.
Farrar & Trefts, Buffalo, N. Y.
Foos Gas Engine Co., Springfield, Ohio.
Gade Bros. Mfg. Co., Iowa Falls, Ia.
Gray Motor Co., Detroit, Mich.
Heer Engine Co., Portsmouth, Ohio.
International Harvester Co., Chicago, Ill.
Mesta Machine Co., Pittsburg, Pa.
Minneapolis Steel & Machinery Co., Minneapolis. "Muenzel".
National Meter Co., New York, "Crown", "Nash".
New Era Gas Engine Co., Dayton, Ohio.
New York Engine Co., New York, N. Y.
New York Safety Steam Power Co., New York. "Dock".
Olds Gas Power Co., Detroit, Mich.
Otto Gas Engine Works, Philadelphia, Pa.
Palmer-Moore Co., Syracuse, N. Y.
Rathbun-Jones Engrg. Co., Toledo, Ohio. "Rathbun".
Rochester Electric Motor Co., Rochester, N. Y. "Service".
Sheffield Gas Power Co., Kansas City, Mo.
Chas. A. Strelinger Co., Detroit, Mich. ("Brush" Lighting Set.)
J. Thompson & Sons Mfg. Co., Beloit, Wis. "Lewis".
Trenton Malleable Iron Co., Trenton, N. J.
Turner-Fricke Mfg. Co., Sharon, Pa.
Western Gas Engine Co., Los Angeles, Calif.
Wisconsin Engine Co., Corliss, Wis. "Complete Expansion", "Sargent".

ENGINES, Oil.
Busch-Sulzer Bros., Diesel Engine Co., St. Louis. "Diesel".
De La Vergne Machine Co., New York. "Hornsby-Akroyd".
Fairbanks, Morse & Co., Chicago, Ill.
Marine Engine & Machine Co., New York. "Secor".
August Mietz, New York. "Mietz & Weiss".
Samuel L. Moore & Sons, Corp., Elizabeth, N. J. "Crescent".
Remington Oil Engine Co., Stamford, Conn.
Chas. A. Strelinger Co., Detroit, Mich.

ENGINES, Steam.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Archer & Baldwin, New York.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Westinghouse Mach. Co., Pittsburgh, Pa.
American Blower Co., Detroit, Mich. "A. B. C."
American & British Mfg. Co., Providence, R. I.
American Engine Co., Bound Brook, N. J. "American Ball".
Ames Iron Works, Oswego, N. Y.
Atlas Engine Works, Indianapolis, Ind.
Ball Engine Co., Erie, Pa.
Ball & Wood Co., Elizabethport, N. J.
Bass Foundry & Machine Co., Fort Wayne, Ind.
Bates Machine Co., Joliet, Ill.
Brownell Co., Dayton, Ohio.
Buckeye Engine Co., Salem, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Chandler & Taylor Co., Indianapolis, Ind.
Comstock Mfg. Co., Comstock, Mich. "Climax".
C. & G. Cooper Co., Mt. Vernon, Ohio.
Erie City Iron Works, Erie, Pa. "Lang".
Erie Engine Works, Erie, Pa.
Erie Mfg. & Supply Co., Erie, Pa. "Erie".
Filer & Stowell Co., Milwaukee, Wis.
Fishkill Landing Machine Co., Fishkill Landing, N. Y.
Fitchburg Steam Engine Co., Fitchburg, Mass.
Franklin Iron Works, Pottsville, Pa.
Frick Co., Waynesboro, Pa. "Eclipse".
William A. Harris Steam Engine Co., Providence, R. I.
Harrisburg Foundry & Machine Works, Harrisburg, Pa.
Herrick Engine Co., New York. (Rotary.)
Hooven, Owens & Rentschler Co., Hamilton, Ohio. "Hamilton".
Houston, Stanwood & Gamble Co., Cincinnati, Ohio.
A. L. Ide & Sons, Springfield, Ill. "Ideal".
International Power Co., Providence, R. I. "Original George H. Corliss", "Green-Wheelock".
Ironton Engine Co., Ironton, Ohio. "Alfree".
Lane & Bodley Co., Cincinnati, Ohio. "Columbian".
McIntosh, Seymour & Co., Auburn, N. Y.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Minneapolis Steel & Machinery Co., Minneapolis, Minn. "Twin City".
Murray Iron Works Co., Burlington, Iowa.
Nagle Corliss Engine Co., Erie, Pa.
New Britain Machine Co., New Britain, Conn. ("Case" Lighting Outfits.)
New York Engine Co., New York. "Watertown".
New York Safety Steam Power Co., New York, N. Y.
Nordberg Mfg. Co., Milwaukee, Wis.
Phoenix Iron Works Co., Meadville, Pa. "Dick & Church".
Providence Engrg. Works, Providence, R. I. "Rice & Sargent", "Greene".
Rochester Machine Tool Works, Rochester, N. Y. "Acme".
Rumley Company, Battle Creek, Mich.
Shepherd Engrg. Co., Williamsport, Pa.
Skinner Engine Co., Erie, Pa.
Southwark Foundry & Machine Co., Phila., Pa. "Porter-Allen".
B. F. Sturtevant Co., Hyde Park, Mass.
Sullivan Machinery Co., Chicago.
Wm. Tod Co., Youngstown, Ohio.
Vilter Mfg. Co., Milwaukee, Wis.
Vulcan Iron Works, Wilkes-Barre, Pa.
Watts-Campbell Co., Newark, N. J.
Robt. Wetherill & Co., Chester, Pa.
Wisconsin Engine Co., Corliss, Wis. "Higher Speed".
York Mfg. Co., York, Pa.

ESCALATORS. See Stairways.

EXCESS INDICATORS.
See Controllers, Flat Rate.

EXHAUSTERS.
See Blowers.

EXPANDERS, Boiler Flue.
J. H. Hallberg, New York.
Helios Mfg. Co., Philadelphia.

EXPANDERS, Boiler Tube.
J. Faesslef Mfg. Co., Moberly, Mo.

EXPANSION BOLTS.
See Bolts.

EXPERIMENTAL APPARATUS.
Delta-Star Electric Co., Chicago.
Esterline Co., Lafayette, Ind.
Keystone Electrical Instrument Co., Philadelphia, Pa.
C. H. Thordarsen Electric Co., Chicago, Ill.

EXTENSION BELLS.
See Generators and Magnetos.

EXTENSIONS, Socket.
Benjamin Elec. Mfg. Co., Chicago, Ill.

EXTINGUISHERS, Fire.
H. W. Johns-Manville Co., New York.
Pyrene Mfg. Co., New York.
O. J. Childs Co., Utica, N. Y.
Staff Fire Extinguisher Co., Chicago.
Tea-Tray Co., Newark, N. J.

FAN DEFLECTORS.
See Deflectors.

FAN MOTOR RESISTANCE.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Western Electric Co., New York.

FANS, Battery.
See Motors, Battery.

FANS, Disc.
Central Electric Co., Chicago, Ill.
Crocker-Wheeler Co., Ampere, N. J.
Diehl Mfg. Co., Elizabethport, N. J.
Eck Dynamo & Motor Co., Belleville, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.
Mechanical Appliance Co., Milwaukee, Wis. "Watson."
Peerless Electric Co., Warren, O.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Works, New York. "Lundell."
Wagner Elec. Mfg. Co., St. Louis, Mo.
Western Electric Co., New York, N. Y. "Hawthorn."
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Acme Ventilating Co., Chicago, Ill.
Aetna Heating Co., New Britain, Conn. "Typhoon."
American Blower Co. (Sirocco Engineering Co.), Detroit, Mich.
Barney Ventilating Fan Co., Boston, Mass.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Geo. P. Clark Co., Windsor Locks, Conn.
Colonial Foundry & Machine Co., South Norwalk, Conn.
Dayton Fan & Motor Co., Dayton, Ohio.
Dover Elec. Mfg. Co., Canal Dover, Ohio.
Exeter Machine Works, Exeter, N. H.
Fuller Co., Detroit, Mich.
Garden City Fan Co., Chicago, Ill.
Green Fuel Economizer Co., Matteawan, N. Y.
Howard & Morse, New York, "National." "Blackman."
Ilg Electric Ventilating Co., Chicago, Ill.
Indiana Fan Co., Indianapolis, Ind.
Kimble Electric Co., Chicago, Ill.
Massachusetts Fan Co., Watertown, Mass. "Davidson."
National Blower Works, Milwaukee, Wis.
New York Blower Co., Chicago.
E. M. Nichols, Philadelphia, Pa.
B. F. Perkins & Son, Holyoke, Mass.
Protective Ventilator Co., New York.
Rochester Electric Motor Co., Rochester, N. Y.
James M. Seymour, Jr., Newark, N. J.
J. F. Snediker, Philadelphia, Pa.
Sterling Blower Co., Hartford, Conn.
B. F. Sturtevant Co., Hyde Park, Mass.
Turbo Blower Co., New York.
L. J. Wing Mfg. Co., New York. "Typhoon." (Turbine Blower System.)

FANS, Motor,
Desk, Ceiling, Column.

Central Electric Co., Chicago, Ill.
Century Electric Co., St. Louis.
Colonial Fan & Motor Co., Warren, Ohio.
Diehl Mfg. Co., Elizabethport, N. J. "Universal."
Eck Dynamo & Motor Co., Belleville, N. J. "Hurricane."
Emerson Electric Mfg. Co., St. Louis, Mo.
Fort Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Hamilton-Beach Mfg. Co., Racine, Wis. "Cyclone".
Manhattan Electrical Supply Co., New York. "Mesco."
Menominee Elec. Mfg. Co., Menominee, Mich. (Portable only.)
Peerless Electric Co., Warren, O.
Robbins & Myers Co., Springfield, Ohio. "Standard."
Sprague Electric Works, New York. "Lundell."
Western Electric Co., New York. "Victor." "Hawthorn."
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Adams-Bagnall Electric Co., Cleveland, Ohio. "Jandus." "Gyrofan."
D. L. Bates & Bro. Co., Dayton, Ohio.
Carleton Co., Boston.
Dayton Fan & Motor Co., Dayton, O.
Fidelity Electric Co., Lancaster, Pa. ("Eclipse" Socket Fans.)
Fulton-Bell Co., New York, N. Y. "Cyclone".
Hunter Fan & Motor Co., New York. ("Portable", "H. E.", "Tuerk", Ceiling.)
Shedd Electric Co., Roselle, N. J.

FAULT FINDERS.
See also Instruments, Testing.

Electric Controller & Mfg. Co., Cleveland, O.
W. N. Matthews & Bro., St. Louis, Mo.

FEEDER ARMS.
See Brackets.

FELT.

American Felt Co., Boston, Mass.
Bacon Felt Co., Winchester, Mass.
N. E. Booth, Brooklyn, N. Y.
Boston Felt Mfg. Co., Boston, Mass.
The Felters Co., New York.
Kenworthy Bros. & Co., Boston, Mass.
F. E. Paige & Co., Boston, Mass.
Tingue, Brown & Co., New York.
Western Felt Works, Chicago, Ill.
Joseph Wild & Co., New York.

FIBRE, Hard.

Mitchell-Rand Mfg. Co., New York.
American Vulcanized Fibre Co., Wilmington, Del.
Concrete Fibre Co., Norristown, Pa.
Continental Fibre Co., Newark, Del.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond State Fibre Co., Elsmere, Del.
Eastern Hard Fibre Co., Merrimac, Mass.
Empire Mfg. Co., Wilmington, Del.
Eureka Supply Co., Sewell, N. J. (Fibre Insulators.)
Keystone Fibre Co., Chester, Pa.
Leatheroid Mfg. Co., Kennebunk, Me. "Dirigo."
National Fibre Board Co., Kennebunk, Me.
National Fibre & Insulation Co., Yorklyn, Del.
J. C. Parker & Sons Fibre Co., New Castle, Del.
Royal Fibre Co., North Cambridge, Mass.
J. Spaulding & Sons Co., North Rochester, N. H. "Cochece."
Standard Fibre Co., Sommerville, Mass.
Wilmington Fibre Specialty Co., Wilmington, Del.

FIELD COIL VARNISH.

See Varnish.

FILAMENTS, Inc. Lamp.

Fahn & McJunkin, New York. "Pianchon."
Filament Supply Co., Boston, Mass.
Francis E. Jackson, Orange, N. J.

FILTERS, Oil.

Elliott Co., Pittsburgh, Pa.
Franklin Oil Filter Co., St. Louis, Mo.

FIRE ALARMS, POLICE SIGNALS, CALL BOXES.

Manhattan Electrical Supply Co., New York.
Western Electric Co., New York, N. Y.
American Electric Fire Alarm & Mfg. Co., Pittsburgh, Pa.
Baltimore Machine Products Co., Baltimore Md. "Viaduct."
Bullock Safety Appliance Co., Poughkeepsie, N. Y. (Closed Circuit Fire Alarm System.)
J. H. Bunnell & Co., New York.
Dean Electric Co., Elyria, Ohio.
Denio General Electric Co., Rochester, N. Y.
De Veau Telephone Mfg. Co., Brooklyn, N. Y. "AUth."
Edwards & Co., New York.
Electrical Automatic Appliance Co., Denver, Colo.
Foote, Pierson & Co., New York.
Gamewell Fire Alarm Teleg. Co., New York.
Gari Electric Co., Akron, Ohio.
Herzog Teleseme Co., New York.
Holtzer-Cabot Elec. Co., Brookline, Mass. (Break Glass.)
International Electric Protection Co., New York.
McFell Electric Co., Chicago, Ill.
National Electric Works, Whittier, Cal. (School System Fire Alarm.)
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Frederick Pearce Co., New York.
Signalphone Alarm Co., Milwaukee, Wis.
Special Fire Alarm Electric Signal Co., New York.
Star Electric Co., Binghamton, N. Y.
Geo. M. Stevens Co., Boston.
Utica Fire Alarm Tel. Co., Utica, N. Y.

FIRE EXTINGUISHERS.

See Extinguishers.

FIREPLACES, Electric.

(See also Radiators.)

General Electric Co., Schenectady.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

FIREPROOF WOOD.

H. W. Johns-Manville Mfg. Co., New York, N. Y.

FISH WIRE.

See Wire, Fish.

FISHING MACHINES, Conduit Fishing.

Pneumatic Conduit Threader Co., Inc., Richmond, Va.
Conduit Machine Co., New York.
Conduit Threading Device Co., Pasadena, Calif.

FITTINGS, Conduit Terminals, Bushings, Entrance Caps.

Appleton Electric Co., Chicago, Ill. "No Thread", "Unilets".
Arrow Electric Co., Hartford, Conn. (Pipe Ends.)
Fairmount Elec. & Mfg. Co., Phila., Pa. (Bendhicks.)
New Process Specialty Co., Inc., Milwaukee, Wis.
H. T. Paiste Co., Phila., Pa. "Taplets".
Sprague Electric Works, New York. "Multilets".
T. W. Manufacturing Co., Milwaukee, Wis. (Loom Clamps.)
Chase-Shawmut Co., Newburyport, Mass.
Crouse-Hinds Co., Syracuse, N. Y. "Condulets".
Electric Specialty Mfg. Co., Providence, R. I. ("Boss" Entrance Bushing.)
Gillette-Vibber Co., New London, Conn.
James C. Phelps, Springfield, Mass. ("J. C. P." Porcelain Cuplets.)
Troy Elect. Co., Troy, N. Y. "Teco".
V. V. Fittings Co., Philadelphia.

FITTINGS, Fixture (Brass).

Fairmount Elec. & Mfg. Co., Phila., Pa. "Arclets" ("Emery" Tripods.)
Faries Mfg. Co., Decatur, Ill.
American Brass & Copper Co., New York.
American Pin Co., Waterbury, Conn.
Art Brass & Fixture Mfg. Co., McKees Rocks, Pa.
Brandt-Dent Co., Watertown, Wis.
Goshen Stamping & Brass Co., Goshen, Ind.
Hudson Brass Works, New York.
Mayer & Reichert, Brooklyn, N. Y. (Fixture Cocks.)
New York Brass Turning Co., New York.
W. W. Partridge, Chicago, Ill.
United Metal Mfg. Co., New York.
J. H. White Mfg. Co., Brooklyn.
R. Williamson & Co., Chicago, Ill.

FITTINGS, Fixture (Iron), Crow Feet, Deupods.

American Brass & Copper Co., New York, N. Y.
Stanley G. Flagg & Co., Philadelphia, Pa.
Macallen Co., Boston, Mass.

FITTINGS, Marine.

See Fixtures, Marine.

FIXTURE ASSEMBLERS' TOOLS.

Goshen Stamping & Brass Co., Goshen, Ind.

FIXTURE CLUSTERS.

See Clusters.

FIXTURE FITTINGS.

See Fittings.

FIXTURE HANGERS.

See Hangers.

FIXTURE STUDS.

See Studs.

FIXTURES, Advertising.

(See also Sidewalk Sign Projectors.)
Atwater Mfg. Co., North Chicago, Ill. ("Cyclo" Revolving Barber Pole.)
General Appliance Mfg. Co., Long Beach, Cal. "Auto Illuminating Advertiser".
S. H. Hoggson & Co., Arlington, N. J. ("Hemafam" Advertising Mechanism.)
Meyercord Co., Chicago, Ill. (Advertising Specialties.)
Multiplex Display Fixture Co., St. Louis, Mo. (Advertising Specialties.)
National Automatic Advertising Co., Chicago. (Stereopticon Advertising Machine.)
Newman Mfg. Co., Cincinnati, O.
Oral & Motion Mfg. Co., Chicago, Ill. (Talking and Moving Advertising Device.)
C. L. Thorne Mfg. Co., Chicago, Ill. (Window Tapper.)
Turner-Ligon Advertising Clock Co., Union City, Tenn.

FIXTURE STRAIGHTENERS.

Fairmount Electric & Mfg. Co., Philadelphia, Pa.
Federal Sign System (Electric), Chicago, Ill.

FIXTURES, Electric & Gas, Tungstoliers, Mazdaliers, Gas Fixtures and Chandeliers.

Frank Adam Electric Co., St. Louis, Mo.
Beardslee Chandelier Mfg. Co., Chicago, Ill.
Central Electric Co., Chicago, Ill.
Faries Mfg. Co., Decatur, Ill.
Federal Sign System (Electric), Chicago, Ill.
Franks Mfg. Co., Rock Island, Ill.
Line Material Co., South Milwaukee, Wis.
St. Louis Brass Mfg. Co., St. Louis, Mo.
Tungstolier Works of General Electric Co., Cleveland, O. (Mazdaliers, Luminier Units.)
Western Electric Co., New York. "Hawthorn" Mazdaliers.
Wheeler Reflector Co., Boston, Mass.
Adams-Bagnall Elect. Co., Cleveland, Ohio. "Abolite".
The Dale Co., New York.
Delta-Star Electric Co., Chicago.
Permel Mfg. Co., Warren, O.
Tilden Saw & Mfg. Co., Wyandotte, Mich.
F. W. Wakefield Brass Co., Vermilion, Ohio.

FIXTURES, Indirect Lighting.

Central Electric Co., Chicago, Ill. "Alexalite".
Federal Sign System (Electric), Chicago, Ill.
H. W. Johns-Manville Co., New York.
National X-Ray Reflector Co., Chicago.
Western Lamp & Brass Works, Chicago, Ill.
Macbeth-Evans Glass Co., Pittsburgh, Pa.

FIXTURES, Show Case.

Benjamin Electric Mfg. Co., Chicago, Ill.
Central Electric Co., Chicago, Ill.
H. W. Johns-Manville Co., New York. "Linolite".
St. Louis Brass Mfg. Co., St. Louis, Mo.
American Reflector & Lighting Co., Chicago, Ill.
Diamond Show Case Co., Cleveland, Ohio.
L. Erickson Electric Co., Boston.
Grand Rapids Fixture Co., Grand Rapids, Mich.
Charles W. Leveredge, New York.
National X-Ray Reflector Co., Chicago, Ill.
Overbagh & Ayres Mfg. Co., Chicago, Ill. "Oamco".
W. W. Partridge, Chicago, Ill.
Reflector & Hdw. Specialty Mfg. Co., Chicago, Ill. "Faussign".
Weeks, Nelson, New York.
Youngstown Glass & Paint Co., Youngstown, Ohio.

FIXTURES, STREET LIGHTING.

For bracket and suspension fixtures, see Street Lighting Fixtures.
For lamp-posts, see Posts.

FIXTURES, Wood.

W. B. Brown Co., Bluffton, Ind.
L. W. Carroll Co., Riverside, Ill.
E. Falkenbach, New York. (Wood Fibre.)

FLASHERS, Sign.

F. Bissell Co., Toledo, Ohio.
Campbell Electric Co., Lynn, Mass.
Phelps Mfg. Co., Detroit, Mich. "Surewink", "Motorless", "Skedoodle".
Reynolds Electric Flasher Mfg. Co., Chicago. "New Reco".
A. & W. Elec. Sign Co., Cleveland, Ohio.
Betts & Betts, New York. "Vacu", "New York".
Bryan Co., Cleveland, Ohio.
Eagle Electric Co., Topeka, Kan.
Electric Carriage Call & Specialty Co., New York.
Farr Telephone & Construction Supply Co., Chicago. "D. & L."
Flexiume Sign Co., Inc., Buffalo, N. Y.
Gillette Electric Co., Chicago, Ill.
Glaze-Morris Mfg. Co., Columbus, Ohio. "Jem".
S. H. Hoggson & Co., Arlington, N. J. "Hemafam".
J. O. Houser Mfg. Co., Buffalo, N. Y. "Economy".
In-er Globe Lamp Co., Boston, Mass.
Kelley & Kelley, Brooklyn, N. Y. "Tic-Tac", "Thermo-Blink".
Reynolds-Dull Flasher Co., Chicago, Ill.
C. O. Schneider & Co., Chicago, Ill. "Firefly".

FLASHLIGHTS.

National Carbon Co., Cleveland, O.
Stanley & Patterson, New York. "Matchless".
American Ever Ready Co., New York. "Ever Ready".
Argus Battery Co., Willimantic, Conn.
Electro Importing Co., New York, N. Y. (Importers.)
Elux Miniature Lamp Works, New York.
Franco-American Electric Novelty Co., New York.
Industrial Novelty Co., Chicago, Ill. (Importers.)
Interstate Electric Novelty Co., New York.
E. Marcuson, New York. "Knockabout".
Metal Specialties Mfg. Co., Chicago, Ill. ("Presto" Flashlight.)
Portable Elec. Safety Light Co., Newark, N. J. ("Hubbell" Storage Battery.)
Providence Electric Mfg. Co., Providence, R. I. "Nitelite." "Little Rhody".
P. W. Electric Co., Toledo, O.
Standard Electric Novelty Co., Chicago, Ill.
Standard Sheet Metal Co., Passaic, N. J. "Rayflex".
E. J. Tardie, New York, N. Y.
Union Battery Co., Belleville, N. J.
Universal Novelty Co., New York. "Milwaukee." "Eclipse."
Vesta Accumulator Co., Chicago, Ill. (Storage Battery.)
Voltamp Electric Mfg. Co., Baltimore, Md.

FLAT IRONS, Electric.

Central Electric Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Diamond Electric Co., Binghamton, N. Y.
General Electric Co., Schenectady, N. Y.
Helion Electric Co., Newark, N. J.
Manhattan Electrical Supply Co., New York.
Phelps Mfg. Co., Detroit, Mich. "So-Easy" and "Venus."
Simplex Electric Heating Co., Cambridge, Mass.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
American Electrical Heater Co., Detroit, Mich.
Bless & Drake, Newark, N. J.
Chicago Flexible Shaft Co., Chicago.
Collier Electric Co., Peterborough, Ont., Can.
Dover Mfg. Co., Canal Dover, O. ("Abesto".)
Economy Electric Co., Brooklyn.
Electric Mfg. Co., San Francisco, Calif.
Guaranty Electric Heater Co., Cleveland, Ohio.
Hindsill Electric Co., Troy, N. Y. ("Brownie" Sad Iron.)
Hot Point Elec. Heating Co., Ontario, Cal.
Loetscher-Ryan Mfg. Co., Dubuque, Ia.
Pelouze Mfg. Co., Chicago, Ill. ("Universal" Sad Irons.)
Pfanstiehl Electric Laboratory, North Chicago, Ill.
Robb & Blackmer, Boston, Mass. (Flask Heaters and Sad Irons.)
Rochester Stamping Co., Rochester, N. Y.
St. Louis Electric Heating Co., St. Louis, Mo. ("Peacemaker" Sad Irons.) "Peerless".
Van Mfg. Co., Braddock, Pa.
Victor Iron Co., Logansport, Ind. (Sad Irons.)
Vulcan Electric Heating Co., Buffalo, N. Y.

FLAT RATE CONTROLLERS.

See Controllers.

FLEXIBLE TUBING.

See Tubing.

FLOOR BOXES.

See Boxes, Floor.

FLOOR CLEANERS AND POLISHERS, Motor Driven Scrubbers and Surfacers.

American Floor Surfacing Machine Co., Toledo, Ohio.
Electric Rotary Machine Co., Chicago, Ill.
Floor Sanding & Polishing Machine Co., Philadelphia, Pa.
Henderson Electric Co., Charlottesville, Va.
Kelley Electric Machine Co., Buffalo, N. Y.
Ransome Concrete Machinery Co., Dunellen, N. J.
M. L. Schlueter, Chicago, Ill.

FLUXES, Soldering.

Blake Signal & Mfg. Co., Boston.
Burnley Battery & Mfg. Co., North East, Pa.
H. W. Johns-Manville Co., New York. ("Solderall" Paste.)

Manhattan Electrical Supply Co., New York. "Excelsior."
McGill Mfg. Co., Valparaiso, Ind. ("Star" Stick Paste & Fluid.)
Western Electric Co., New York. ("Hawthorn" Stick.)
L. B. Allen Co., Chicago, Ill. ("The Allen" Stick, Paste and Salts.)
Alex R. Benson Co., Hudson, N. Y. ("Yager's".)
Brunner Chemical Works, Cincinnati, Ohio. "Queene".
Bull Dog Specialty Co., South Bend, Ind. (Stick & Paste.)
Geo. Callahan & Co., New York. (Fluid.)
Central Stamping Co., New York. ("Soldering" Paste and Salts.)
Chicago Solder Co., Chicago, Ill. ("Kester" Paste and Salt.)
Como Electrical Co., Spring Lake, N. J. "Hiko".
Corliss Chemical Co., St. Louis, Mo. (Stick, Paste and Salts.)
Di-Electric Mfg. Co., St. Louis.
Dow Chemical Co., Midland, Mich.
M. W. Dunton Co., Providence, R. I. "Nokorode".
Electric Traction Supply Co., St. Louis, Mo. ("I. X. L." Salts.)
Elliott Chemical Works, Newton, Mass. (Fluid.)
Grasselli Chemical Co., Cleveland, Ohio. "Eureka," "Standard," "Snowflake."
Wm. J. Hartwig Co., Detroit, Mich. "New Idea".
Hess & Son, Philadelphia, Pa. ("Tinol" Paste.)
Highland Electro-Chemical Mfg. Co., Connellsville, Pa.
Knoblock-Heideman Mfg. Co., South Bend, Ind. ("Bulldog" Paste.)
Chas. W. Leveridge, New York. "Yankee".
Read Mfg. Co., **Hoboken, N. J.** ("Incomparable" Fluid.)
Ruby Chemical Co., Johnstown, Ohio. ("Imperial" Paste and Salts.)
Emil Schneider, Inc., Newark, N. J.
Standard Chemical Co., Cincinnati, Ohio. ("Imperial" Paste and Salts.)
J. F. Walsh Co., Pittsfield, Mass. ("Norcross" Stick, Paste and Fluid.)

FORGINGS.
American Bridge Co., New York.

FORMERS, Armature.
See Coil Forming Devices.

FORMERS, Tie Wire.
Chance Mfg. Co., Centralia, Mo.
Only Mfg. Co., Moravia, Iowa.

FOUNTAINS, Electric.
Battaglia Elec. Fountain Co., New York.
F. W. Darlington, Philadelphia, Pa.
M. B. Jones, Boston, Mass.

FREQUENCY INDICATORS.
Badt-Westburg Electric Co., Inc., Chicago.
James G. Biddle, Philadelphia. "Frahm".
Machado & Roller, New York. (Hartmann & Braum.)

FRICTION TAPES & CLOTHS.
See Tape.

FRINGES.
See Crystals.

FROSTING.
See Coloring.

FUEL ECONOMIZERS.
See Economizers.

FULLER BOARD.
See Paper.

FURNACES, Electric.
See also Heating Devices.
American Electric Furnace Co., New York.
W. Green Electric Co., New York.
Hoskins Mfg. Co., Detroit, Mich.
Keystone Electrical Instrument Co., **Philadelphia, Pa.**
Multiple Unit Electric Co., New York.
Pelton & Crane Co., Detroit, Mich.

FUSE BLOCKS.
See Cut-Outs.

FUSE PLUGS.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Arrow Electric Co., Hartford, Conn. "Arrotype."
D & W Fuse Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
H. W. Johns-Manville Co., New York. "Noark".
H. T. Paiste Co., Philadelphia, Pa. "Fusettes."
Stanley & Patterson, New York, N. Y.
Union Electric Co., Trenton, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.
Western Electric Co., New York, N. Y.
The Bryant Electric Co., Bridgeport, Conn. "Pyrolite."
Condit Elec'l Mfg. Co., Boston, Mass.
C. S. Knowles, Boston.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Russell & Stoll Co., New York.
Weber Electric Co., Boston, Mass.
Wirt Mfg. Co., Burrage, Mass. "Wirt."

FUSE SWITCH BOXES.
See Switches, Disconnecting.

FUSED SWITCHES. See Switches, Combination Cutout.

FUSE TESTERS.
See Testers.

FUSE WIRE.
Appleton Electric Co., Chicago.
Chicago Fuse Mfg. Co., Chicago.
General Electric Co., Schenectady, N. Y.
Western Electric Co., New York.
Condit Elec'l Mfg. Co., Boston, Mass. "Shawmut."
Harvard Electric Co., Chicago, Ill.

FUSES, ENCLOSED, Cartridge Type, (Approved).
Central Electric Co., Chicago, Ill.
Chicago Fuse Mfg. Co., Chicago.
D & W Fuse Co., Providence, R. I.
Detroit Fuse & Mfg. Co., Detroit, Mich. "Arkless."
General Electric Co., Schenectady, N. Y.
H. W. Johns-Manville Co., New York, N. Y.
Westinghouse Electric Mfg. Co., E. Pittsburgh, Pa.
Bryant Electric Co., Bridgeport, Conn.
Chase-Shawmut Co., Newburyport, Mass.
Condit Elec. Mfg. Co., Boston, Mass. "Shawmut."

FUSES, ENCLOSED, Cartridge Type, (Refilled).
Multi Refillable Fuse Co., Chicago, Ill.
Ackley Brake & Supply Co., New York.
A. F. Daum Co., Pittsburgh, Pa.
James S. Johnston Mfg. Co., Utica, N. Y., ("Visible" Refilled.)
Long Beach Electric Co., Long Beach, Cal. "Tidmarsh Recharging."
Metropolitan Engineering Co., Brooklyn, N. Y.
E. W. Snow & Co., Rochester, N. Y. (Refilled.)
Trio Mfg. Co., Rock Island, Ill. "Tornquist."

FUSES, Enclosed, Cartridge Type. (Renewable.)
Economy Fuse & Mfg. Co., Chicago, Ill.
Multi Refillable Fuse Co., Chicago, Ill.

FUSES, High Tension.
Chemelectric Co., Chicago.
Delta-Star Electric Co., Chicago.
Schweitzer & Conrad, Chicago, Ill., S. & C. High Potential.

FUSES, Open Link.
Appleton Electric Co., Chicago.
Chicago Fuse Mfg. Co., Chicago.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric Mfg. Co., E. Pittsburgh, Pa. (Aluminum.)
Chase-Shawmut Co., Newburyport, Mass. "Shawmut."
C. McIntire Co., Newark, N. J
Walker Electric Co., Philadelphia, Pa.

FUSES, Telephone and Telegraph.
Appleton Electric Co., Chicago, Ill. "Veribest."
Chicago Fuse Mfg. Co., Chicago.
D & W Fuse Co., Providence, R. I.
H. W. Johns-Manville Co., New York, N. Y.
Baltimore Machine Products Co., Baltimore, Md. (Telegraph Protectors.)
Central Telephone & Electric Co., St. Louis, Mo. "Gilgen."
Cook, Frank B., Chicago, Ill.
Foote-Pierson Co., New York, N. Y. (Telegraph Protectors.)
Hall, Frank B., Newton Falls, O.
Wm. J. Hartwig Co., Detroit, Mich.
Harvard Electric Co., Chicago, Ill. "Greer."
Lafayette Electric & Mfg. Co., Lafayette, Ind. (Heat Coils.)
Nagel-Chase Mfg. Co., Chicago, Ill. "N. C."
Reliable Electric Co., Chicago, Ill.

GAINS, Steel.
Hallett Iron Works, Chicago.

GALVANOMETERS.
See Instruments.

GARAGE PUMPS.
See Pumps, Garage.

GAS ENGINES.
See Engines, Gas.

GAS FIXTURE ATTACHMENTS.
See Attachments, Gas.

GAS LIGHTING BURNERS.
See Burners, Gas Lighting.

GAS PRODUCERS.
See Producers, Gas.

GASKETS, Metallic.
See Packing.

GATES, Head.
American Bridge Co., New York.

GAUGE COCKS, Water.
Ohio Brass Co., Mansfield, Ohio.
Williams Gauge Co., Pittsburgh, Pa.

GAUGES, Battery.
(See also Ammeters.)
Hoyt Electrical Instrument Wks., Penacook, N. H.
Manhattan Electrical Supply Co., New York, N. Y. "Universal," "Ditmar," "Elite."
American Ever Ready Co., New York, N. Y.
Atwater Kent Mfg. Works, Philadelphia, Pa. "Dri-Sell."
Baird Elec. Co., Chicago, Ill.
Connecticut Tele. & Elec. Co., Meriden, Conn.
Dow Mfg. Co., Braintree, Mass.
Eldredge Elec. Mfg. Co., Springfield, Mass. "Advance," "Express." "Eclipse."
Never-Miss Mfg. Co., Lansing, Mich.
Pierson-Wilcox Electric Co., Minneapolis, Minn.
Robert Instrument Co., Detroit, Mich.
Standard Electric Time Co., Waterbury, Conn. "Warner's."

GAUGES, Wire.
Manhattan Electrical Supply Co., New York. ("U. S.," "Lutz," Self-Registering.)
Brown & Sharpe Mfg. Co., Providence, R. I.
Novelty Electric Co., Philadelphia, Pa. "Neco."
M. S. Shapleigh, Roslyn, Pa. (Self-Registering.)
L. S. Starrett Co., Athol, Mass.
Vulcan Hdw. Co., Carlstadt, N. J.

GEARS, Rawhide and Composition.
General Electric Co., Schenectady, N. Y.
New Process Gear Corporation, Syracuse, N. Y.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Grant Gear Works, Boston, Mass.
Horsburgh & Scott Co., Cleveland, Ohio. "Peerless."
R. D. Nuttall Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, Ohio.
Western Rawhide & Belting Co., Milwaukee, Wis. "Superior."

GENERATORS.
(See also Motors and Dynamos.)
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Fort Wayne Electric Works, Fort Wayne, Ind.
General Electric Co., Schenectady.
Mechanical Appliance Co., Milwaukee, Wis.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Triumph Electric Co., Cincinnati.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Electric Specialty Co., Stamford, Conn.

GENERATING SETS.
See Plants, Lighting.

GLASS COVERS.
Haskins Glass Co., Wheeling, W. Va.

GLASSWARE, Illumtnating.
Central Electric Co., Chicago, Ill.
Gill & Co., Inc., Philadelphia, Pa.
Holophane Works of General Electric Co., Cleveland ,O.
Phoenix Glass Co., New York, N. Y. "Pheno."
St. Louis Brass Mfg. Co., St. Louis, Mo.
Western Electric Co., New York, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.
Cleveland Window Glass & Door Co., Cleveland, Ohio. "Cleveglass."
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Frang Euler & Co., New York, N. Y. (Importers.)
Fensterer & Ruhe, New York, N. Y.
Friedelaender, Oscar O., New York, N. Y. (Importer.)
Gill Bros. Co., Steubenville, O.
Gillinder & Sons, Philadelphia, Pa. "Magian."
Gleason-Tiebout Glass Co., Brooklyn, N. Y. "Camia," "Gletieco."
Haskins Glass Co., Wheeling, W. Va.
Jefferson Glass Co., Follansbee, W. Va. "Luceo."
Kirchberger & Co., M., New York, N. Y. (Importers.)
Krakno Glass Co., Pittsburgh, Pa. "Ray Do."
National X-Ray Reflector Co., Chicago, Ill. "Scoop," "Helmet," "Poke-Bonnett," "X-Ray," "I-Comfort."
Opalux Co., New York, N. Y., "Camia," "Carra," "Glerieco" "Opalux."
Pairpoint Corporation, New Bedford, Mass.
Pittsburg Lamp, Brass & Glass Co., Pittsburgh, Pa.
Wellington Glass Co., Cumberland, Md.

GLOBES, Waterproof.
("Vaporproof" Globes.)
Federal Sign System (Electric), Chicago, Ill.
E. H. Freeman Electric Co., Trenton, N. J.
Henry Newgard & Co., Chicago.

GLOBE NETS AND GUARDS.
See Nets.

GLOBES, Arc Light.
(Outer and Inner.)
General Electric Co., Schenectady, N. Y.
Gill & Co., Inc. (Washington Flint Glass Works), Philadelphia, Pa.
Holophane Works of General Electric Co., Cleveland, O.
Phoenix Glass Co., New York. (Inner and Outer.)
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Edward E. Cary Co., New York. (Importers "Cohesive".)
Fensterer & Ruhe, New York (Import, Inner.)
Haskins Glass Co., Wheeling, W. Va.
Gill Bros. Co., Steubenville, O.
Gillinder & Sons (Franklin Flint Glass Works), Philadelphia, Pa.
Gleason-Tiebout Glass Co., Brooklyn, N. Y.
Libbey Glass Co., Toledo, Ohio (Inner.)
Lippincott Glass Co., Alexandria, Ind.
Macbeth-Evans Glass Co., Pittsburgh, Pa.
Mound Valley Glassware Mfg. Co., Mound Valley, Kas.
J. J. Murray & Co., Philadelphia, Pa. (Outer Globes Only.)
Pairpont Corporation, New Bedford, Mass.
Wellington Glass Co., Cumberland, Md.

GLOBES, Glass.
See Glassware; also Marine **Fixtures.**

GLOVES, Linemen's.
Morrison-Ricker Mfg. Co., Grinnell, Ia.

GLOVES, Rubber.
Canton Rubber Co., Canton, Ohio
Goodyear's India Rubber Glove Mfg. Co., New York, N. Y.

GLUE POTS, Electric.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Diamond Electric Co., Binghamton, N. Y.
General Electric Co., Schenectady, N. Y.
Simplex Electric Heating Co., Cambridge, Mass.
American Electrical Heater Co., Detroit, Mich.

GONGS, Electro Mechanical.
W. R. Ostrander & Co., New York, N. Y.
Bryant Zinc Co., Chicago, Ill.
J. H. Bunnell & Co., New York, N. Y.
Edwards & Co., New York.
Electric Goods Mfg. Co., Canton, Mass. "Sun."
Gamewell Fire Alarm Tel. Co., New York, N. Y.
Holtzer-Cabot Electric Co., Brookline, Mass.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Frederick Pearce Co., New York N. Y.
Railroad Supply Co., Chicago, Ill
Star Electric Co., Binghamton, N. Y.

GONGS (Unmounted Bells).
Bridgeport Brass Co., Bridgeport, Conn.
The American Tube & Stamping Co., Bridgeport, Conn.
Bevin Bros. Mfg. Co., **East Hampton, Conn.** "Barton".
Catasauqua Gong & Stamping Works, Catasauqua, Pa.
East Hampton Bell Co., **East** Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
N. N. Hill Brass Co., East Hampton, Conn.
G. C. Reiter, Canton, Ohio. "Cheswick".
Starr Bros. Bell Co., East Hampton, Conn.
Waterbury Mfg. Co., Waterbury, Conn.

GOOSENECKS.
See Street Fixtures.

GOVERNORS, Engine.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Lombard Governor Co., Ashland, Mass. (Electric Speed Controllers.)
Lensed Electric Shade Co., New York, N. Y. "Gilbert Reflectors".
Macbeth-Evans Glass Co., Pittsburgh, Pa. "Maxdalite," "Alba", and "Ivalux".
H. G. McFadden & Co., New York. "Emeralite".
Mound Valley Glassware Mfg. Co., Mound Valley, Kas.
Murray & Co., J. J., Philadelphia.
Wm. R. Noe & Sons, New York.

GOVERNORS, Water Wheel.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Holyoke Mach. Co., Worcester, Mass.
Lombard Governor Co., Ashland, Mass.
Lombard & Replogle Engrg. Co., Akron, O.
Ludlow Valve Mfg. Co., Troy, N. Y. "Sturgess".
Woodward Governor Co., Rockford, Ill.

GRAPHITE.

Joseph Dixon Crucible Co., Jersey City, N. J.
Holmes Fibre-Graphite Mfg. Co., Germantown, Pa.
Asbury Graphite Mills, Asbury, N. J.
Chester Graphite Co., Chester Springs, Pa.
Elk Graphite Milling Co., St. Marys, Pa.
International Acheson Graphite Co., Niagara Falls, N. Y.
U. S. Graphite Co., Saginaw, Mich.
Wisconsin Graphite Co., Stevens Point, Wis.

GRAPHITED GREASE.
International Acheson Graphite Co., Niagara Falls, N. Y.

GRINDERS, Portable.
See Tools, Portable.

GROUND ANCHORS.
(See Anchors.)

GROUND CLAMPS.

Appleton Electric Co., Chicago.
Benjamin Electric Mfg. Co., Chicago.
Blackburn Specialty Co., Cleveland, Ohio.
Bossert Co., Utica, N. Y.
Fairmount Electric & Mfg. Co., Philadelphia, Pa. "All-in-one", "Vogel".
Federal Sign System (Electric), Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn. "O. K."
High Tension Electrical Specialty Co., Newton, Mass.
Hubbard & Co., Pittsburgh, Pa.
Mineraliac Electric Co., Chicago.
H. T. Paiste Co., Philadelphia, Pa. "Perma-Effect."
Sprague Electric Works, New York, N. Y.
Thomas & Betts Co., New York.
Western Electric Co., New York.
American Cable Clip Co., New York. "Simplex."
American Metal Works, Philadelphia, Pa.
W. A. Bonnell Co., New York.
Cameron Appliance Co., Everett, Mass. "Boston", "Perfect", "McCoy".
Chase-Shawmut Co., Newburyport, Mass.
Wm. H. Colgan Co., West Newton, Mass. "Rex."
Condit Electrical Mfg. Co., Boston, Mass. "Shawmut."
J. W. Copeland, Minneapolis, Minn.
Electric Specialty Co., Philadelphia, Pa. "Easy".
Gillette Vibber Co., New London, Conn.
Geo. Heinemann & Co., Philadelphia, Pa. "Advance".
Hallett Iron Works, Chicago, Ill.
Hinsdill Electric Co., Troy, N. Y.
Kinsey Mfg. Co., Toledo, Ohio.
Lord Mfg. Co., Brooklyn, N. Y.
Milwaukee Electrical Specialties Co., Milwaukee, Wis. "M. & B".
Novelty Electric Co., Philadelphia, Pa. "Flexiclamp", "Griptite".
Rochester Electric Motor Co., Rochester, N. Y. "Remco."
Stevens Mfg. Co., Woodbury, N. J.
Yonkers Specialty Co., Yonkers, N. Y. "Yonkers", "New York".

GROUND DETECTORS.
See Instruments.

GROUNDING DEVICES.
See also Ground Clamps.
Blackburn Specialty Co., Cleveland, O.
Dossert & Co., New York, N. Y.
Fairmount Electric & Mfg. Co., Philadelphia, Pa.
Federal Sign System (Electric), Chicago, Ill.
Brach, L. S., Supply Co., New York.
Hallett Iron Works, Chicago, Ill.
Lord Mfg. Co., Brooklyn, N. Y. "Hydro-Ground".
Paragon-Sellers Co., Chicago, Ill. (Ground Cones.)
Randolph Insulator Co., Newark, N. J.

GUARDS, Arc Lamps.
See Nets and Guards.

GUARDS, Fan.
Inglis Wire & Iron Works, Detroit, Mich.

GUARDS, Inc. Lamp.
Benjamin Electric Mfg. Co., Chicago, Ill. "Can't Break".
H. W. Johns-Manville Co., New York.
W. N. Matthews & Bro., St. Louis, Mo. "Holdfast".
McGill Mfg. Co., Valparaiso, Ind. "Protector", "Bull Dog", "Wager", "Loxon".
Gail-Webb Mfg. Co., Buffalo, N. Y.
Greenwood Mfg. & Supply Co., Boston, Mass. "Peerless".
Hamblin & Russell Mfg. Co., Worcester, Mass.
Holdfast Lamp Guard Co., St. Louis, Mo.
Harvey Hubbell, Bridgeport, Conn.
Wm. Inglis Wire & Iron Works, Detroit, Mich. "Perfection".
Joseph, S., New York, N. Y.
Morse, Frank W., Boston, Mass.
National Mfg. Co., Worcester, Mass.
Russell & Stoll Co., New York.
Standard Wire Co., Newcastle, Pa.
Western Wire Goods Co., Buffalo.
Wire Goods Co., Worcester, Mass.

GUARDS, Locking.
W. N. Matthews & Bro., St. Louis, Mo.
McGill Mfg. Co., Valparaiso, Ind. "Loxon".
Harvey Hubbell, Bridgeport.
Chas. W. Leveridge, New York.

GUARDS, Portable Lamp.
Benjamin Electric Mfg. Co., Chicago, Ill. "Protectalite".
General Electric Co., Schenectady, N. Y.
McGill Mfg. Co., Valparaiso, Ind. "Bull Dog", "Standard A", "Security", "National". "Improved Protector", "London".
Culver-Stearns Mfg. Co., Worcester, Mass.
Electric Service Supplies Co., Philadelphia, Pa. "Keystone".
Frink, I. P., New York, N. Y.
Hamblin & Russell Mfg. Co., Worcester, Mass.
Harvard Electric Co., Chicago, Ill.
Joseph, S., New York, N. Y.
H. Krantz Mfg. Co., Brooklyn, N. Y.
F. H. Lovell & Co., Arlington, N. J.
Morse, Frank M., Boston, Mass.
Novelty Electric Co., Philadelphia, Pa. (Bung Hole Lamp and Guard.)
Overbagh & Ayres Mfg. Co., Chicago, Ill. "Oamco".
Robb & Blackmer, Boston, Mass.
P. Sorensen, Brooklyn, N. Y.
Stehlin-Miller & Henes Co., New York. "Rockoff".
Frank H. Stewart Electric Co., Philadelphia, Pa. "Adjustandle".
Taylor, Wm., New York. "Safety".

GUY ANCHORS.
See Anchors.

GUY CLAMPS.
American Steel & Wire Co., Chicago, Ill. "Crosby".
Barnes & Kobert Mfg. Co., New Haven, Conn.
W. N. Matthews & Bro., St. Louis, Mo. "Boltless" and "Two-Bolt".
American Hoist & Derrick Co., St. Paul, Minn.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Cincinnati Wire Rope Co., Cincinnati, Ohio.
Cook, Frank B., Chicago, Ill.
Hallett Iron Works, Chicago, Ill.
Hoopes & Townsend Co., Philadelphia, Pa.
Lamson & Sessions Co., Cleveland, Ohio. "Double Grip", "Bull Dog".
M. Lanz & Sons, Pittsburgh, Pa.
Macomber & Whyte Rope Co., Chicago, Ill.
Michigan Bolt & Nut Works, Detroit, Mich.
National Telephone Supply Co., Cleveland, Ohio.
Newhall Chain Forge & Iron Co., New York. "Trident".
Norton, W. T., West Park, Ohio.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Philadelphia Electric Mfg. Co., Philadelphia.
Schaper Construction Material Co., New York, N. Y.
St. Louis Malleable Casting Co., St. Louis, Mo.
Steel Car Forge Co., Pittsburgh.
Union Elevator & Machine Co., Chicago, Ill.

HAIR DRIERS.
Hamilton-Beach Mfg. Co., Racine, Wis. "Cyclone".
Sanax Co., Inc., New York. "Foen."
American Electrical Heater Co., Detroit, Mich.
Barker, James, Philadelphia, Pa.
Birtman Electric Co., Chicago, Ill. "Bee".
Camp Co., La Crosse, Wis. "Invincible".
Electric Mfg. Co., San Francisco.
Fidelity Electric Co., Lancaster, Pa. "Eclipse".
Halliwell & Co., New York, N. Y.
Horn Electric Co., Chicago, Ill.
Lindstrom-Smith Co., Chicago, Ill. ("White Cross".)
Wm. Meyer Co., Chicago, Ill.
Royal Specialty Co., Cleveland, Ohio.
Shelton Electric Co., New York.
Standard Electric Works, Racine, Wis. ("Arnold".)
Thome, M., Chicago, Ill.
Walters, W. J., Syracuse, N. Y. (Mer-Maid" Hair Drier and Hair Singer.)

HANDLES, Socket.
See Guards, Portable.

HANDLES, Switch (Wood).
For Switch Handles of Rubber or Composition see Insulation. For Fibre Switch Handles see Fibre.
American Enamel Co., Providence, R. I.
Bogert & Hopper, New York, N. Y.
Detroit Handle Co., Detroit.
E. B. Estes & Sons, New York.
Novelty Turning Co., Norway, Me.
H. A. Stiles & Co., Boston, Mass.
Union Hardware Co., Torrington, Conn.

HANGER BOARDS, Arc Lamp.
Brady Electric Mfg. Co., New Britain, Conn.
Fort Wayne Electric Works, Ft. Wayne, Ind.
H. T. Paiste Co., Philadelphia, Pa. (Fusible.)
Western Electric Co., New York.
Lundin Elec. & Machine Co., Boston, Mass.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Worcester Electric & Mfg. Co., Worcester, Mass.

HANGERS, Arc Lamp.
See Insulators, Arc Lamp.
Brackets, Arc Lamp.
Pulleys, Arc Lamp.
Pulleys, Cut-out.

HANGERS, Cable.
See Cable Hangers.

HANGERS, Conduit and Moulding.
Mineraliac Electric Co., Chicago, Ill.
Western Electric Co., New York.

HANGERS, Fixture.
J. Gordon Knight Electric Co., New York, N. Y.
Empire Engineering & Supply Co., New York, N. Y.

HANGERS AND CLAMPS.
Conduit Hangers, Pipe Hangers, Beam Clamps, Pipe Straps.
Appleton Electric Co., Chicago.
F. Bissell Co., Toledo, Ohio. "Security". (Concrete.)
Mineraliac Electric Co., Chicago.
W. R. Ostrander & Co., New York, N. Y. "Atlas".
Pass & Seymour, Inc., Solvay, N. Y.
Sprague Electric Works, New York.
Steel City Electric Co., Pittsburgh, Pa. ("Fullman" Beam Stropes.)
Thomas & Betts Co., New York, N. Y. "Box Hanger".
W. A. Bonnell Co., New York.
Fee & Mason, New York. "F. & M.", "A. B. C."
S. R. Fralick & Co., Chicago. "Kwikon".
Grabler Mfg. Co., Cleveland, O.
W. F. Irish Electric Co., New York. "Shamrock".
E. H. Lovell Co., Arlington, N. J.

HAT CLEANERS, Motor Driven.
Bosso, Paul, Scranton, Pa. "Star".
Fidelity Electric Co., Lancaster, Pa. "Universal".
Saylor Electric Co., Pittsburgh, Pa. (Hat Chuck.)
Schnauffer, Wm. A., New York.

HEADLIGHTS, Automobile.
See Lamps, Automobile.

HEATERS, Electric (Miscellaneous).
See also Flat Irons, Curling Irons, Cooking Devices, Soldering Irons, Hair Driers, Heating Pads.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Diamond Electric Co., Binghamton, N. Y.
Helion Electric Co., Newark, N. J.
Pheips Mfg. Co., Detroit, Mich.
Simplex Electric Heating Co., Cambridge, Mass.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wirt Co., Philadelphia, Pa.
Advance Machinery Co., Toledo, Ohio. (Glue Pots.)
Butte Engineering & Electric Co., San Francisco, Cal.
Despatch Mfg. Co., Minneapolis.
Detroit Elec. Heater Co., Detroit, Mich. ("Calor" Sad Irons and Water Heaters.)
Diamond Electric Water Heater Co., San Francisco, Cal.
Electric Device Co., Los Angeles, Cal. ("Quick Hot" Liquid Heater.)
Electric Heater Storage Co., New York. (Importers House Heaters.)
Electro Dental Mfg. Co., Philadelphia, Pa. (Water Heaters and Sterilizers.)
Elgin Electrical Mfg. Co., Elgin, Ill.
Hoskins Mfg. Co., Detroit, Mich. (Furnaces, Soldering Irons and "Toastove" Toasters.)
Insto-Electric Heater Co., Cincinnati, Ohio. (Water Heaters and Sterilizers.)
Katz, Louis, San Francisco, Cal.
C. W. Leavitt & Co., New York. ("Girod" Furnace for Refining Steel.)
Meier Dental Mfg. Co., St. Louis, Mo. (Water Bottle Heater.)
National Electric Co., Chicago.
National Stamping & Electric Works, Chicago, Ill. (Hot Water Heaters.)
Pelouze Mfg. Co., Chicago.
Pelton & Crane, Detroit, Mich. (Furnaces and Dental Appliances.)
Presto Electrical Mfg. Co., San Francisco, Cal.
Prometheus Electric Co., New York, N. Y.
Rathbone Fireplace Mfg. Co., Grand Rapids, Mich. (Stoves and Fireplace.)
Rochester Stamping Co., Rochester, N. Y.
Simplex Engineering Co., Philadelphia, Pa. "Quartzalite" Heaters.
Toennes, Richard, Boonville, Mo. ("Little Giant" Water Heaters.)

HEATER INDICATING RECEPTACLE.
Machen & Mayer Elec. Mfg. Co., Philadelphia.

HEATING PADS AND BLANKETS.
H. W. Johns-Manville Co., New York, N. Y. ("Electrotherm" Heating Pads, Blankets and Caps.)
Pheips Mfg. Co., Detroit, Mich. "Flexo."
Simplex Electric Heating Co., Cambridge, Mass.
American Electrical Heater Co., Detroit, Mich.
Juniper Electric Products Co., Cleveland, O.
National Electric Co., Chicago. "Neco," "Ozone."
C. A. Shaler Co., Waupun, Wis. "Electropad."

HEATING SYSTEMS. Exhaust Steam.
American District Steam Co., North Tonawanda, N. Y.
Evans, Almirall & Co., Chicago, Ill.
Harrison Safety Boiler Works, Philadelphia, Pa.
Michigan Pipe Co., Bay City, Mich.
W. H. Pearce & Co., Chicago, Ill. "Crescent".

HICKIES.
See Studs.

HOISTING MACHINERY, Electric, Mine.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
General Electric Co., Schenectady.

HOISTS.
See Cranes.

HOLDERS, Shade.
See Shade-holders.

HOODS, Street.
See Fixtures, Street.

HOOKS, Insulating.
See Rings.

HORNS, Electric for Automobile and Factory Use.
Manhattan Electrical Supply Co., New York, N. Y. "Mesco."
Schwarze Electric Co., Adrian, Mich.
American Electric Co., Chicago. "Samson."
Automobile Supply Mfg. Co., Brooklyn, N. Y. "Newtone."
Dean Electric Co., Elyria, Ohio. "Tuto Horn."
Edwards & Co., New York, N. Y. "Dixie."
Electric Auto Horn Co., Pittsburgh, Pa. "Duplex."
Electric Horn & Specialty Co., Utica, N. Y. **"Oneida."**
Elgin Electrical Mfg. Co., Elgin, Ill.
Elkhart Electro-Corno Co., Elkhart, Ind. "Electro-Corno."
Theo H. Gary Co., New York, N. Y. "Grack-Unicum."
Holtzer - Cabot Electric Co., Brookline, Mass. "Autobia."
Industrial Instrument Co., Foxboro, Mass.
Lovell-McConnell Mfg. Co., Newark, N. J. "Klaxon."
O'Brien Electrophone Co., Hallowell, Me.
Russell Electric Co., Danbury, Conn. "Saxon," "Rapid Fire," "Treco."
Sirene Co., New York, N. Y.
Standard Electric Works, Racine, Wis. "Arnold."
Typhoon Signal Co., Chicago, Ill.

HORSE CLIPPERS.
See Clippers.

HOSE, Rubber.
B. F. Goodrich Co., Akron, Ohio.
Peerless Rubber Mfg. Co., New York, N. Y.

HOUSES, Pole or Pilot.
F. Bissell Co., Toledo, Ohio. "Security."
Central Telephone & Electric Co., St. Louis, Mo.
Cook, Frank B., Chicago, Ill.

HUSKS.
See Spinnings.

HYDROMETERS AND SYRINGES.
E. Marcuson, New York, N. Y. "Withan."
Philadelphia Thermometer Co., Philadelphia, Pa.
Queen-Gray Co., Philadelphia, Pa.
Storage Battery Supply Co., New York, N. Y. "Reliance."
C. J. Tagliabue Mfg. Co., New York.
Taylor Bros. Co., Rochester, N. Y.
Turner Brass Works, Sycamore, Ill.
Charles A. Vuille, Huntingdon, Pa.

ICE MACHINES.
See Refrigerators.

IMPREGNATING COMPOUNDS.
See Varnish.

IMPREGNATORS.
See Driers.

INCUBATORS, Electric.
Cyphers Incubator Co., Buffalo.
Electrical Automatic Appliance Co., Denver, Colo.
Electric Mfg. Co., New Orleans.

INDICATORS, Polarity.
See Indicators, Testing.

INDICATORS, Speed.
See Tachometers.

INDICATORS, Steam Engine.
American Steam Gauge & Valve Co., Boston, Mass.
Ashcroft Mfg. Co., New York, N. Y.
Lippincott, S. S. & S. Co., Newark, N. J.
Jas. L. Robertson & Sons, New York, N. Y.
Schaeffer & Budenberg Mfg. Co. Brooklyn, N. Y.
Star Brass Mfg. Co., Boston.

INDIRECT LIGHTING FIXTURES.
See Fixtures, Indirect.

INJECTORS AND EJECTORS.
American Injector Co., Detroit, Mich. "U. S."
Hancock Inspirator Co., New York, N. Y.
Hayden & Derby Mfg. Co., New York, N. Y. "Metropolitan."
Penberthy Injector Co., Detroit, Mich.

INNER GLOBES.
See Globes, Arc Light.

INSTRUMENTS, Power Factor Meters, Recording Meters, Frequency Meters, Ground Detectors, Synchroscopes, Laboratory Apparatus.
Badt-Westburg Electric Co., Inc., Chicago.
Bristol Co., Waterbury, Conn. (Recording.)
Fort Wayne Electric Works, Ft. Wayne, Ind. "Wood."
General Electric Co., Schenectady, N. Y. "Thompson."
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Hoyt Electrical Instrument Works, Penacook, N. H.
H. W. Johns-Manville Co., New York. ("Victor" Combination.)
Manhattan Electrical Supply Co., New York, N. Y. (Polarity Indicators.)
Sangamo Electric Co., Springfield, Ill.
Wagner Elec. Mfg. Co., St. Louis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Co., Waverly Park, Newark, N. J.
Automatic Electric Co., Chicago, Ill. (Condensers.)
James G. Biddle, Philadelphia, Pa. (Importer "Siemens & Halske".)
Century Electrical Co., Syracuse, N. Y. (Field Tester.)
Dongan Electric Mfg. Co., Detroit, Mich.
T. H. Du Vivier, New York, N. Y. (Importer "Richard" Recording.)
Eager Electric Co., Watertown, N. Y.
Eldredge Electric Mfg. Co., Springfield, Mass.
Esterline Co., Lafayette, Ind. Dynamometers, Laboratory Apparatus, Special Devices.
Hoskins Mfg. Co., Detroit, Mich.
International Instrument Co., Cambridge, Mass.
Industrial Instrument Co., Foxboro, Mass.
Jewell Elec. Inst. Co., Chicago, Ill.
Keystone Elec. Inst. Co., Philadelphia, Pa.
Machado & Roller, New York, N. Y. (Sole Selling Agents for Roller-Smith Co., Bethlehem, Pa.) (Importers "Hartmann & Braun.")
Norton Electrical Instrument Co., Manchester, Conn.
Pignolet, L. M., New York, N. Y.
Queen-Gray Co., Philadelphia, Pa.
Reliance Instrument Co., Chicago, Ill.
Robert Instrument Co., Detroit, Mich.
Steel Glass Co., Philadelphia, Pa. (Ground Detectors.)
Thwing Instrument Co., Philadelphia, Pa.
Triplett Meter Co., Bluffton, O.

INSTRUMENTS, Pole Measuring.
United Electric Co., Marion, O. "Vertascope".

INSTRUMENTS, Switchboard.
See Ammeters, and Voltmeters, Wattmeters, Frequency Indicators.

INSTRUMENTS, Testing, Electroscopes, Galvanometers, Wheatstone Bridges, Testing Sets, Ohmmeters, Condensers, Dynamometers.
Electric Controller & Mfg. Co., Cleveland, O. (Fault Finder.)
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Leeds & Northrup Co., Philadelphia, Pa. (Fault Finders, Cable Testers and Laboratory Instruments.)
Machado & Roller, New York, N. Y. (Sole Selling Agents for Roller-Smith Co., Bethlehem, Pa.) ("Sage" Ohmmeters.)
W. N. Matthews & Bro., St. Louis, Mo. (Fault Finders.)
Mineral Electric Co., Chicago, Ill. (Portable Cable Testing Sets, Electroscopes, Phase Rotation Indicators.)
States Co., Hartford, Conn. (Meter Testers.)
James G. Biddle, Philadelphia, Pa. (Importer "Siemens & Halske".)
J. H. Bunnell & Co., New York.
Century Electrical Co., Syracuse.
Chemelectric Co., Chicago. (High voltage and fault detectors.)
Electric Specialty Mfg. Co., Cedar Rapids, Iowa. (Wireless Cable Testers.)
L. M. Ericsson Telephone Mfg Co., Buffalo, N. Y. (Lineman's Test Set.)
Foote, Pierson & Co., New York.
Green Electric Co., W., New York.
W. & L. E. Gurley, Troy, N. Y.
Keystone Electrical Instrument Co., Philadelphia, Pa.
Manufacturers and Inventors' Electric Co., New York, N. Y. "Troy".
Marcuson, E., New York, N. Y. (Portable Testing Batteries.)
Marshall, Wm., New York, N. Y.
Wm. J. Murdock Co., Chelsea, Mass.
Fred'k Pearce Co., New York, N. Y.
Queen-Gray, Philadelphia, Pa.
Thompson-Levering Co., Philadelphia, Pa.
Wireless Cable Tester Co., Cedar Rapids, Iowa.

INSTRUMENTS, Wireless.
See Wireless Apparatus.

INSULATED WIRE CONNECTORS.—N. E. C.
U. S. E. M. Co., New York.

INSULATING CEMENTS.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Dickinson Mfg. Co., Springfield, Mass.
Flintkote Mfg. Co., New York, N. Y.
Massachusetts Chemical Co., Walpole, Mass.

INSULATING MACHINERY, Wire Covering Machinery.
New England Butt Co., Providence, R. I.

INSULATING PAINTS AND COMPOUNDS.
Chicago Mica Co., Valparaiso, Ind. "Champion."
General Bakelite Co., New York.
H. W. Johns-Manville Co., New York, N. Y. "Phoenix", "J. M."
McGill Mfg. Co., Valparaiso, Ind. ("Crescent Chatterton".)
Mica Insulator Co., New York, N. Y. **"M. I. C.", "Linolac".**
Mineral Electric Co., Chicago, Ill.
Mitchell-Rand Mfg. Co., New York. "B. S." "Electric Black".
Standard Paint Co., New York, N. Y. "P. & B."
Sherwin-Williams Co., Cleveland, Ohio.
Standard Underground Cable Co., Pittsburgh, Pa. "Oxite".
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
American Mica Co., Newton Lower Falls, Mass. "A. M. C."
Benolite Co., Pittsburgh, Pa.
Berry Bros., Detroit, Mich.
L. S. Brach Supply Co., New York, N. Y. "Victolac".
Emil Calman & Co., New York, N. Y.
Candy & Co., Chicago, Ill. "Faultless".
Cochrane Chemical Co., Jersey City, N. J.
Condensite Co. of America, Glen Ridge, N. J.
Dielectric Co. of America, Belleville, N. J.
Dielectric Mfg. Co., St. Louis.
John C. Doiph Co., Newark, N. J. "Jayseedee."
Eagle Paint & Varnish Co., Pittsburgh, Pa.
Flintkote Mfg. Co., New York, N. Y. "Rex Elec. Insulating Compound".
Franklin Co., Bound Brook, N. J. "B. & B."
Insulatine Co., New York, N. Y.
Lowe Bros. Co., Dayton, O.
Massachusetts Chemical Co., Walpole, Mass. "Union Splice", "Neponset", "Maschemco", "Enamelac", "Walpole", "Armalac".
National Insulator Co., Boston, Mass. "Nico".
Plas-Mica Co., Yonkers, N. Y.
P. & M. Co., Chicago, Ill. "A. C."
Raven Mining Co., Chicago, Ill. "Gilsonite" (Elaterite), "Kapac".
Standard Asphalt & Rubber Co. ("Carco" Asphaltic), Chicago, Ill.
Standard Varnish Works, New York.
Sterling Varnish Co., Pittsburgh, Pa.
Toch Bros., New York. "R. I. W."
E. T. Trotter & Co., Brooklyn, N. Y.
Voltax Co., New York.
R. S. Van Kokeritz & Co., New York, N. Y. (Importers "Cosmos".)
Warren Chemical & Mfg. Co., New York. (Asphaltic.)
E. A. Wilhelmi Co., New York, N. Y.

INSULATION, Overhead.
See Line Material.

INSULATION, Hard Moulded Composition and Rubber, Bushings, Battery Jars, Battery Jar Covers, Receiver Shells, Telephone Mouthpieces, Trolley Insulators, Socket Keys, Switch Handles, Sheet-Rod-Tube.
Electrose Mfg. Co., Brooklyn, N. Y. (Composition.)
General Bakelite Co., New York.
General Insulate Co., Brooklyn, N. Y.
Goodrich Co., Akron, Ohio.
Hemming Mfg. Co., Garfield, N. J. "Tegit", "Gummon", "Hemit" Composition.
Scranton Button Co., Scranton, Pa. "Composition".
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
American Hard Rubber Co., New York, N. Y.
Auburn Button Works, Auburn, N. Y. (Composition.)
W. S. Brock Rubber Co., Boston.
Byerley & Son, Cleveland, Ohio. ("Byerlyte" Asphalt.)
Condensite Company, Glen Ridge, N. J.
Dickinson Mfg. Co., J. H. Parker, Sales Agt., Boston. "Sternold" and "Sterno-Condensite".
Duranoid Mfg. Co., Newark, N. J.
Luzerne Rubber Co., Trenton, N. J.
Morgan & Wright, Detroit, Mich. (Rubber.)
Northern Industrial Chemical Co., Boston, Mass.
Siemon Hard Rubber Corporation, Bridgeport, Conn.
J. Stokes Rubber Co., Trenton, N. J.
Vulcanized Products Co., Muskegon, Mich.
Vulcanized Rubber Co., New York, N. Y.
Wilkie Rubber Mfg. Co., Lynn, Mass.

INSULATOR PINS.
See Pins, also Brackets.

INSULATORS, Arc Lamp. (Insulated Hangers.)
Albert & J. M. Anderson Mfg. Co., Boston, Mass
Geo. Cutter Co., South Bend, Ind.
General Electric Co., Schenectady, N. Y.
H. W. Johns-Manville Co., New York, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Fletcher Mfg. Co., Dayton, O.
Line Material Co., S. Milwaukee, Wis.
Macallen Co., Boston, Mass.
Philadelphia Electric Mfg. Co., Philadelphia.
Thos. Wrigley & Co., Chicago, Ill.

INSULATORS, Canopy.
(See Canopy Insulators.)

INSULATORS, Glass.
General Electric Co., Schenectady, N. Y.
Hemingray Glass Co., Covington, Ky. "Triple Petticoat", "Muncie Type", "Provo Type".
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
The Brookfield Glass Co., New York, N. Y. "Combination Safety", "Mershon", "Barclay", "Brown", "Crown", "O'Brien", "Columbia", "Jumbo", "Edison".
California Glass Insulator Co., Los Angeles, Calif.
Haskins Glass Co., Wheeling, W. Va.
Knowles, C. S., Boston, Mass. "Crown".
Locke Insulator Mfg. Co., Victor, N. Y. "Triple Petticoat".

INSULATORS, High Voltage.
Electrical Engineers' Equipment Co., Chicago, Ill.
Fairmount Electric & Mfg. Co., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
H. W. Johns-Manville Co., New York, N. Y. "J. M."
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. "Nikonew".
Locke Insulator Mfg. Co., Victor, N. Y. "Victor".
Ohio Brass Co., Mansfield, Ohio.
Pittsburgh High Voltage Insulator Co., Derry, Pa.
R. Thomas & Sons Co., East Liverpool, Ohio. "Boch".

INSULATORS, Lava.
See Lava.

INSULATORS, Porcelain.
See Porcelain.

INSULATORS, Pull Chain.
Arrow Electric Co., Hartford, Conn.
Harrigan, T. M., Woodstock, Vt.

INSULATORS, Street Fixtures.
See Street Fixtures, Street. . .

INSULATORS, Tree.
(See Tree Insulators.)

INSULATORS, Wood.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Mineraliac Electric Co., Chicago.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Aerial Conduit Co., Wabash, Ind.
IRIDIO-PLATINUM, Wire and Sheet.
Baker & Co., Newark, N. J.

IRON AND STEEL, For Armature and Magnet Punchings.
American Sheet & Tin Plate Co., Pittsburgh, Pa. "American Armature", "Apollo", "Pole Face", "U. S. Electrical".
American Rolling Mill Co., Middletown, Ohio.
Edward E. Cary Co., New York, N. Y. (Importers.)
Follansbee Brothers Co., Pittsburgh, Pa.

IRONS, Soldering and Branding.
See Soldering Irons.

JACK STRAPS.
See Linemen's Tools.

JARS, Battery (Glass.)
Hemingray Glass Co., Covington, Ky.
Brookfield Glass Co., New York, N. Y.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons (Franklin Flint Glass Works), Philadelphia, Pa.
Illinois Glass Co., Chicago, Ill.
C. P. Lovering & Co., J. H. Parker, Sales Agt., Boston.
Mississippi Glass Co., New York.
Whitall-Tatum Co., Philadelphia.
Whitney Glass Works, Philadelphia, Pa.

JEWELS, for Instrument Bearings.
American Oil & Supply Co., Newark, N. J.
Diamond Cupped Bearing Co., New York, N. Y.
Fisher & Vinal Jewel Co., Waltham, Mass.
W. W. Mildrum, East Berlin, Conn.
H. E. Oppenheimer & Co., New York, N. Y.
John Wennstrom's Sons Co., Suffern, N. Y.
John Worley, Waltham, Mass.

JOINTS, Cable.
Dossert & Co., New York.
General Electric Co., Schenectady, N. Y.

JOINTS, Cable-Splicing.
See Cable Splicing Joints.

JOINTS, Fixture Insulating.
Federal Sign System, (Electric), Chicago. "Dielite".
Thomas & Betts Co., New York.
Trumbull Electric Mfg. Co., Plainville, Conn.
Wirt Electric Specialty Co., Philadelphia, Pa. "Di-El-Ite".
Stanley G. Flagg & Co., Philadelphia, Pa.
Ideal Socket Key Mfg. Co., Los Angeles, Calif.
Macallen Co., Boston, Mass.

JUNCTION BOXES.
See Boxes.

KEYS, SOCKET, Detachable.
(For regular socket keys, see Insulation, Moulded.)

KITCHEN CABINETS.
Federal Sign System, (Electric), Chicago. "Federal".

KITS, Tool.
See Tools, Linemen's.

KNIFE SWITCHES.
See Switches, Knife.

KNOBS, Porcelain.
See Porcelain.

LACQUER, Lamp.
See Coloring.

LACQUER, Metal.
General Bakelite Co., New York.
M. L. Barrett & Co., Chicago, Ill.
Celluloid Zapon Co., New York.
James B. Day & Co., Chicago, Ill.
Egyptian Lacquer Mfg. Co., New York.
C. E. Franche & Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Lacquer Radiant Co., Philadelphia, Pa.
G. J. Nikolas & Co., Chicago, Ill.
Pacific Electric Co., La Crosse, Wis. "Platone."
W. Zinsmer & Co., New York.

LAMPS, Arc.
Albert & J. M. Anderson Mfg. Co., Boston, Mass. ("Monarch" Enclosed.)
Archer & Baldwin, New York.
Central Electric Co., Chicago, Ill.
Fort Wayne Electric Works, Fort Wayne, Ind. ("Wood" Enclosed.)
General Electric Co., Schenectady, N. Y. Enclosed, Flame, Series Luminous, Intensified, Ornamental Series Luminous, Luminous Arc Headlights.
Koerting & Mathiesen Co., New York. "Excello".
Western Electric Co., New York. ("Hawthorn" Flaming and "Solaris" "Hawthorn" Miniature.)
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. (Enclosed and Magnetite.)
Adams-Bagnall Electric Co., Cleveland, O.
American Arc Lamp Co., Kalamazoo, Mich. ("Northall," "Lea" Enclosed.)
American Flaming Arc Lamp Co., Boston, Mass. (Flaming.)
Aurora Electric Co., Aurora, Ind. (Miniature.)
Bell Arc Light Co., New York. (Flaming.)
Eclipse Electric Arc Light Co., New York. (Miniature.)
Economy Electric Co., Brooklyn, N. Y. (Enclosed.)
Helios Mfg. Co., Philadelphia, Pa. ("Continental" Enclosed and Flaming.)
Hirschberg Co., H. M., New York, N. Y. (Import "Siemens" Flaming.)
Hunt & McCree, New York. ("Lustrelite" Enclosed.)
Imperial Electric Mfg. Co., New York. (Enclosed.)
C. L. Kiewert Co., Milwaukee, Wis. (Import "Aurora" and "Alba" Flaming.)
Lord Mfg. Co., Brooklyn, N. Y. ("Luminator" Flaming and "Heany" and "Luminet" Enclosed.)
Main Electric Co., New York. (Importers Flaming.)
Philadelphia Electrical & Mfg. Co., Philadelphia, Pa. "Tungsten Arc".
Radio Reflector Co., New York, (Enclosed.)
Scott Electrical Co., Newark, N. J. (Flaming.)
Stave Elect'l Co., New York. ("Stavelco" Miniature Enclosed and Flaming.)
Stillwell Van Demark Co., New York. ("Stilvan" Miniature.)
Sunray Electric Lamp Mfg. Co., New York. (Diminutive Flaming.)
C. J. Toerring Co., Philadelphia, Pa. (Flaming and Enclosed.)
Volkmer Electrical Co., New York. ("Daylight" Enclosed.)
Warner Lamp Co., Davenport, Iowa.

LAMPS, Automobile, Electric, Head, Side, Tail.
Adams & Westlake Co., Chicago, Ill. "Adlake."
Apple Electric Co., Dayton, Ohio.
Avery Portable Lighting Co., Milwaukee. ("Electrobola" Headlight.)
Badger Brass Mfg. Co., Kenosha, Wis.
A. S. Campbell Co., Boston, Mass. "Cello."
Castle Lamp Co., Amesbury, Mass.
Chicago Auto Lamp Works, Chicago, Ill.
C. Cowles & Co., New Haven, Conn.
Culver-Stearns Mfg. Co., Worcester, Mass.
R. E. Dietz Co., New York.
Edmunds & Jones Mfg. Co., Detroit, Mich.
Elgin Electrical Mfg. Co., Elgin, Ill.
English & Mersick Co., New Haven, Conn.
Fowler Lamp & Mfg. Co., Chicago, Ill.
Gray & Davis, Amesbury, Mass.
Guide Motor Lamp Mfg. Co., Cleveland, Ohio.
C. M. Hall Lamp Co., Detroit.
Hartman Electrical Mfg. Co., Mansfield, Ohio.
Knoop Battery Co., Detroit, Mich. "Wizard."
Miller-Sprague-Waldo Mfg. Co., Detroit, Mich. "Britelyte."
Milwaukee Bronze Casting Co., Milwaukee, Wis. "Electric Star."
Joseph F. O'Brien Co., New York.
Scoville & Peck Co., New Haven, Conn.
Silvey Electric Co., Dayton, O.
Vesta Accumulator Co., Chicago.
White Diamond Co., Indianapolis, Ind.
White Mfg. Co., Bridgeport, Conn.

LAMP CHANGERS OR REPLACERS.
W. N. Matthews & Bro., St. Louis, Mo. "Easy".
McGill Mfg. Co., Valparaiso, Ind. "Bates."
E. E. Edgerton, Chicago, Ill.
Frank W. Morse, Boston, "Handy."
State Elec. Mfg. Co., Boston. "Tite-Grip."

LAMP GUARDS.
See Guards.

LAMPS, Incandescent. Miniature, Carbon Filament, Metal Filament.
Central Electric Co., Chicago, Ill.
Independent Lamp and Wire Co., New York.
Laco-Phillips Co., New York.
National Quality Lamp Division of General Electric Company—the following member works:
American Electric Lamp Works, Central Falls, R. I.
Banner Electric Works, Youngstown, Ohio.
Brilliant Electric Works, Cleveland, Ohio.
Bryan-Marsh Electric Works, Central Falls, R. I.
Bryan-Marsh Electric Works, Chicago, Ill.
The Buckeye Electric Works, Cleveland, Ohio.
Colonial Electric Works, Warren, Ohio.
The Columbia Incandescent Lamp Works, St. Louis, Mo.
Elux Miniature Lamp Works, New York, N. Y.
Federal Miniature Lamp Works, Chicago, Ill.
The Fostoria Incandescent Lamp Works, Fostoria, Ohio.
General Incandescent Lamp Works, Cleveland, Ohio.
Monarch Inc. Lamp Works, Chicago, Ill.
Munder Electric Works, Central Falls, R. I.
Packard Lamp Works, Warren, Ohio.
The Peerless Lamp Works, Warren, Ohio.
Shelby Lamp Works, Shelby, Ohio.
Standard Electric Works, Warren, Ohio.
The Sterling Electric Lamp Works, Warren, Ohio.
Sunbeam Incandescent Lamp Works, New York, N. Y.
Sunbeam Incandescent Lamp Works, Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Aetna Electric Co., New York.
American Electric Lamp Co., New York.
American Miniature & Decorative Lamp Co., New York. "Ever Ready."
Chicago Miniature Lamp Works, Chicago, Ill.
Cleveland Miniature Lamp Co., Cleveland, Ohio (Tungsten.)
Eclipse Inc. Lamp Co., Toledo, Ohio.
Elblight Co. of America, New York (Special Decorative.)
Electro Importing Co., New York. (Importers.)
Farkas Tungsten Lamp Co., Bloomfield, N. J.
Franco-American Electric Novelty Co., New York. (Importers.)
Gudeman & Co., New York. (Importers.)
Howard Miniature Lamp Co., Newark, N. J. (Metallic or Carbon Filament.)
Industrial Novelty Co., Chicago, Ill. (Importers.)
H. W. McCandless & Co., New York. "Empire."
Novelty Incandescent Lamp Co., Emporium, Pa.
P. W. Electric Co., Toledo, O.
F. J. Rooney Lamp Co., Hoboken, N. J.
Standard Elec. Novelty Co., Chicago, Ill.
Vacuum Glass Co., Lynn, Mass.
Vosburgh Miniature Lamp Co., West Orange, N. J.
Alfred Wolff & Co., New York. (Importers.)

LAMPS, Incandescent, Carbon Filament, Metal Filament, Tungsten, Mazda, Tantalum, Gem, Series, Regulating, Turndown, Glower, Reflector, Meridian.
Boston-Economy Lamp Works, Danvers, Mass.
H. W. Johns-Manville Co. New York, N. Y. "Linolite."
Independent Lamp & Wire Co., New York.
Laco-Phillips Co., New York.
Lux Manufacturing Co., New York.
National Quality Lamp Division of General Electric Company, comprising the following member works, [All types and sizes Mazda (drawn-wire), tantalum, gem and carbon lamps except where otherwise indicated.]
American Electric Lamp Works, Central Falls, R. I.
Banner Electric Works, Youngstown, Ohio.
Brilliant Electric Works, Cleveland, Ohio.
Bryan-Marsh Electric Works, Central Falls, R. I.
Bryan-Marsh Electric Works, Chicago, Ill.
The Buckeye Electric Works, Cleveland, Ohio.
Colonial Electric Works, Warren, Ohio.
The Columbia Incandescent Lamp Works, St. Louis, Mo.
Economical Electric Lamp Works, New York, N. Y. (Turn-down lamps—Mazda and carbon).
The Economy Electric Works, Warren, Ohio. (Refilled carbon lamps).
Elux Miniature Lamp Works, New York City. (Miniature lamps—Mazda and carbon.)
Federal Miniature Lamp Works, Chicago, Ill. (Miniature lamps—Mazda and carbon.)
The Fostoria Incandescent Lamp Works, Fostoria, Ohio.
General Incandescent Lamp Works, Cleveland, Ohio.
Monarch Incandescent Lamp Works, Chicago, Ill.
Munder Electric Works, Central Falls, R. I.
Packard Lamp Works, Warren Ohio.
The Peerless Lamp Works, Warren, Ohio.
Shelby Lamp Works, Shelby, Ohio.
Standard Electric Works, Warren, Ohio.
The Sterling Electric Lamp Works, Warren, Ohio.
Sunbeam Incandescent Lamp Works, New York, N. Y.
Sunbeam Incandescent Lamp Works, Chicago, Ill.
New York Incandescent Lamp Co., New York. ("Regent", Metal Filament and "The Best" Carbon Filament.)
Union Light & Supply Co., Chicago.
Western Electric Co., New York.
Westinghouse Lamp Co., Bloomfield, N. J.
Aetna Electric Co., New York. ("Mazda" Drawn Wire.)
American Electric Lamp Co., New York.
American "Z" Electric Lamp Co., New York. (Metal Filament.)
Boston Incandescent Lamp Co., Danvers, Mass.
Capital Electric Co., Denver, Colo. "Hal"
Consolidated Electric Lamp Co., Danvers, Mass. ("Champion" Carbon Filament.)
Eastern Electric Lamp Co., Boston, Mass.
Eclipse Inc. Lamp Co., Toledo, Ohio.
Elblight Co. of America, New York. (Decorative Lamps and Cables.)
Electrical Accessaries Co., New York. (Importers "Justram" Tungsten.)
Farkas Tungsten Lamp Co., Bloomfield, N. J.
Fensterer & Rube, New York. (Import "Gratzin" Tungsten.)
Franklin Electric Mfg. Co., Hartford, Conn.
Gilmore Electric Co., S. Boston, Mass.
Holscher Elect. Mfg. Co., Warren, Ohio. "Model".
Hygrade Incandescent Lamp Co., Danvers, Mass.
Kentucky Electrical Co., Owensboro, Ky.
C. S. Knowles, Boston, Mass.
Liberty Electric Mfg. Co., Pittsburgh, Pa.
Nernst Lamp Co., Pittsburgh, Pa. (Glower.)
New England Lamp Co., Malden, Mass.
Novelty Inc. Lamp Works, Emporium, Pa. "Any Angle" "Elk".
F. J. Rooney Lamp Co., Hoboken, N. J. (Sun-Star Turndown and "World" Carbon.)
Standard Electric Lamp Co., Newark, N. J. "Newark", "Shamrock".

Straight Filament Lamp Co., New York. (Tube.)
U. S. Inc. Lamp Co., St. Louis.
Vacuum Glass Co., Lynn, Mass. "Lowvolt".

LAMPS, Incandescent, Renewed.

National Quality Lamp Division of General Electric Company—the following member works:
Boston Incandescent Lamp Works, Danvers, Mass.
The Economy Electric Works, Warren, Ohio.
Aladdin Electric Co., Warren, Ohio.
Anchor Lamp Co., New York.
Bay State Lamp Co., Danvers, Mass. "Eclipse", "Bay State".
Eagle Lamp Co., Danvers, Mass.
Essex Lamp Co., Danvers, Mass.
Holscher Electrical Mfg. Co., Warren, Ohio. "Reliance".
International Electric Co., Danvers, Mass.
Lynn Incandescent Lamp Co., Lynn, Mass.
Lyons Electric Co., Newark, N. J.
Phoenix Electric Co., Warren, Ohio.
Re-New Lamp Co., Boston, Mass. "Malden."
Safety Electric Co., Chicago, Ill.
Standard Electric Lamp Co., Newark, N. J.

LAMPS, Photo Engraving.

General Electric Co., Schenectady, N. Y.
Adams-Bagnall Electric Co., Cleveland, Ohio.
C. J. Bogue Electric Co., New York.
Eastman Kodak Co., Rochester, N. Y. "Aristo."
Wm. H. Havill, Chicago, Ill.
Macbeth Arc Lamp Co., Philadelphia, Pa.
New York Engravers' Supply Co., New York.
A. T. Thompson & Co., Boston.
C. J. Toerring Co., Philadelphia.

LAMPS, Portable.

See Guards, Portable Lamp, also Lamps, Trouble.

LAMPS, Trouble, Automobile, Portable, Hand.

Manhattan Electrical Supply Co., New York. "Mesco."
McGill Mfg. Co., Valparaiso, Ind.
American Enamel Co., Providence, R. I. "Britelite."
American Ever Ready Co., New York.
Metal Specialties Mfg. Co., Chicago, Ill.
Frank W. Morse, Boston, Mass.
Providence Electric Mfg. Co., Providence, R. I. "Nitelite."

LAMPS, Vapor and Vacuum Tube.

Cooper Hewitt Electric Co., Hoboken, N. J. (Mercury Vapor and Quartz Tube.)
General Electric Co., Schenectady.

LANTERNS.

See Flashlights.

LAUNDRY MACHINERY (Electrically operated.)

American Ironing Machine Co., Chicago, Ill. "Simplex."
American Laundry Machinery Co., Rochester, N. Y.
Barnes & Payton, Troy, N. Y.
National Laundry Machinery Co., Chicago, Ill.
National Marking Machine Co., Cincinnati, Ohio.
Steel Roll Machine Co., Chicago, Ill. "Clean Linen."
S. M. Supplies Co., Boston, Mass. (Marking Machines.)
Troy Laundry Machinery Co., Chicago, Ill.

LAVA.

American Lava Co., Chattanooga, Tenn. "Alco."
Colonial Mfg. Co., Chattanooga, Tenn.
M. Kirchberger & Co., New York. "Crescent."
Novelty Burner Co., Chattanooga, Tenn.
D. M. Steward Mfg. Co., Chattanooga, Tenn. "Lavite."

LEATHER MACHINERY.

See Shoe and Leather Machinery.

LEATHER WASHERS.

See Washers, Leather.

LETTER BOXES.

Manhattan Electrical Supply Co., New York, N. Y.
Francis Keil & Son, New York.

LICENSE NUMBERS, Illuminated.

See Numbers.

LIFTING MAGNETS.

See Magnets, Lifting.

LIGHTERS, Cigar.

See Cigar Lighters.

LIGHTERS, Gas, Electric Torches for hand use.

Stanley & Patterson, New York. "Matchless."
Adjustable Lighter Co., Newton, Mass.
American Ever Ready Co., New York, N. Y.
A. L. Bogart, New York, N. Y.
Cary Co., Edward E., New York.
C. Cowles & Co., New Haven, Conn.
Electric Goods Mfg. Co., Canton, Mass.
Loomis Specialty Co., Minneapolis, Minn.
Wm. Roche, Jersey City, N. J.
Standard Sheet Metal Co., Passaic, N. J. "Rayflex."
Universal Novelty Co., New York. "Aladdin."

LIGHTING PLANTS.

Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Mechanical Appliance Co., Milwaukee, Wis.
American Battery Co., Chicago.
Apple Electric Co., Dayton, Ohio.
Carlisle & Finch Co., Cincinnati, Ohio.
Dayton Electrical Mfg. Co., Dayton, Ohio.
Fairbanks-Morse Co., Chicago.
Inst. Lighter Co., Columbus, Ohio.
Knop Battery Co., Detroit, Mich.
Moon Mfg. Co., Chicago, Ill.
National Meter Co., New York.
New Britain Machine Co., New Britain, Conn. ("Chase" Lighting Outfits.)
Richardson Engineering & Mfg. Co., Hartford, Conn.
Rochester Electric Motor Co., Rochester, N. Y. "Service."
Silvey Electric Co., Dayton, O.
Chas. A. Strelinger Co., Detroit, Mich. ("Brush" Lighting Set.)

LIGHTNING ARRESTERS for Lighting and Power Circuits.

Albert & J. M. Anderson Mfg. Co., Boston, Mass. "Ajax."
General Electric Co., Schenectady.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa. "Wurtz."
Delta-Star Electric Co., Chicago. "Horn Gap."
Electric Service Supplies Co., Philadelphia, Pa., "Garton-Daniels."
Gifford Electric Mfg. Co., Traverse City, Mich.
Lord Mfg. Co., Brooklyn, N. Y. "Multi-Vapo-Gap", "Shaw".
Railway & Industrial Eng'g. Co., Pittsburgh, Pa. (Horn type.)
Randolph Insulator Co., Newark, N. J. "Shaw."
W. D. Woolley, St. Louis, Mo. "C-C Non-Gap."

LIGHTNING ARRESTERS, for Telephone Circuits.

Central Electric Co., Chicago, Ill.
Vote-Berger Co., La Crosse, Wis.
L. S. Brach Supply Co., New York.
Chance Mfg. Co., Centralia, Mo. "Skyrocket."
Metallic Lightning Arrester Co., Winona, Minn.
Minnesota Electric Co., Minneapolis, Minn. "Chapman."
National Electric Specialty Co., Toledo, Ohio. "Vac-M."

LIGHTS, Automobile.

See Outfits, also Lamps, Automobile.

LIGHTS, Desk, Desk Lights, Wall Brackets, Desk Clamps.

Beers Sales Co., Bridgeport, Conn. "Lynne."
Faries Mfg. Co., Decatur, Ill.
Federal Sign System (Electric), Chicago, Ill. "Universal."
Franks Mfg. Co., Rock Island, Ill.
H. W. Johns-Manville Co., New York, N. Y. "Linolite."
Stanley & Patterson, New York. "Sunlight."
St. Louis Brass Mfg. Co., St. Louis, Mo.
Wheeler Reflector Co., Boston.
J. Alexander Mfg. Co., New York. (Ball Bearing.)
Almond Mfg. Co., T. R., Ashburnham, Mass.
American Brass & Copper Co., New York. (Desk Lamp.)
American Electric Co., Chicago, Ill. "More-Light." "Read-Easy." "All-Ways."
Butler Mfg. & Plating Co., Boston, Mass.
Coder & Missic, Mariner Harbor, N. Y.
Dale Co., The, New York, N. Y.
C. G. Everson & Co., Chicago, Ill.
Peter Forg, Somerville, Mass.
Frantz Mfg. Co., Sterling, Ill. ("Best-Yet" Orchestra Shade.)
Gall-Webb Mfg. Co., Buffalo, N. Y.
Handy Light Co., Cincinnati.
Harley Machine Co., Springfield, Mass.
W. S. Hawker, Dayton, Ohio. "Universal."
Klemm & Co., Philadelphia, Pa.
McFaddin & Co., H. G. New York, N. Y. "Emeralite."
McLeod, Ward & Co., New York. ("Ward" Orchestra) "Comfort" Bed Reading Lamp ("Kinsman" Desk.)
McKenna Bros. Brass Co., Pittsburgh, Pa. (Desk Stands.)
Frank W. Morse, Boston, Mass.
Oliver Electric Co., Philadelphia, Pa. "Flexilite." "Equipoise."
Overbagh & Ayres Mfg. Co., Chicago, Ill. "Oamco."
Pacific Electric Co., La Crosse, Wis. "Badger."
Paragon Sellers Co., Chicago, Ill.
Patterson Tool & Supply Co., Dayton, Ohio.
A. C. Scribner, Gloversville, N. Y.
John J. Waldman, New York. ("Jones" Desk Clamp.)
Wells Light Mfg. Co., Jersey City, N. J. "Wallworks."
O. C. White Co., Worcester, Mass.
J. H. White Mfg. Co., Brooklyn, N. Y. "Zenith."
Williamson Co., A. L., New York, N. Y. "Flexilyte."

LIGHTS, Stage, Bunch, Foot, Spot, Strip.

F. Bissell Co., Toledo, Ohio. "Security."
Campbell Electric Co., Lynn, Mass.
Universal Elec. Stage Lighting Co., "Kliegl Bros." New York.
Am. Reflector & Ltg. Co., Chicago, Ill.
Condit Elect'l Mfg. Co., Boston.
Electric Mfg. Co., New Orleans.
Electric Stage Lighting Co., Chicago, Ill.
I. P. Frink, New York.
Globe Electric Specialties Co., New York.
J. H. Hallberg, New York.
Kansas City Scenic Co., Kansas City, Mo.
Jos. Menchen Elec. Co., New York.
C. I. Newton, New York.
Overbagh & Ayres Mfg. Co., Chicago.
J. S. Pennefather, New York.

LINE MATERIALS.

Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Brady Electric Mfg. Co., New Britain, Conn.
Central Electric Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Hubbard & Co., Pittsburgh, Pa.
H. W. Johns-Manville Co., New York, N. Y.
Line Material Co., South Milwaukee, Wis.
W. N. Matthews & Bro., St. Louis, Mo.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co. East Pittsburgh, Pa.
Philadelphia Elec. Mfg. Co., Philadelphia, Pa.

LINKS, Fusible.

See Fuses.

LOCK NUTS.

See Bushings.

LOCKS, Door.

See Openers.

LOCKING GUARDS.

See Guards.

LOCKING SOCKETS.

See Sockets.

LOCKERS, Metal (for employees' clothes).

Allsteelequip Co., Aurora, Ill.
Edward Darby & Sons Co., Philadelphia.
Hess Warming & Ventilating Co., Chicago.

LOCKS, Pole.

Line Material Co., So. Milwaukee, Wis.
Fletcher Mfg. Co., Dayton, Ohio.

LOCOMOTIVES, Electric.

General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
American Locomotive Co., New York.
Atlas Car & Mfg. Co., Cleveland, Ohio.
Baldwin Locomotive Works, Philadelphia, Pa.
Goodman Mfg. Co., Chicago, Ill.
C. W. Hunt Co., West New Brighton, N. Y. (Storage Battery).
Jeffrey Mfg. Co., Columbus, Ohio.
McGuire Cummings Mfg. Co., Chicago, Ill.
Pneumelectric Machine Co., Syracuse, N. Y.

LUBRICANTS.

See also Oils, Lubricating.

Dearborn Chemical Co., Chicago, Ill.
Joseph Dixon Crucible Co., Jersey City, N. J. (Graphite.)
International Acheson Graphite Co., Niagara Falls, N. Y. "Oildag."
Keystone Lubricating Co., Philadelphia. (Keystone Grease.)

LUGS, Terminal.

Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Chicago Fuse Wire & Mfg. Co., Chicago. "Union."
Dossert & Co., New York.
Electrical Engineers Equipment Co., Chicago.
Trumbull Electric Mfg. Co., Plainville, Conn.
Agutter-Griswold Co., Seattle, Wash.
Barkelew Electric Mfg. Co., Middletown, Ohio.
Bliss-Chester Co., Providence, R. I. "Duplex."
Crouse-Hinds Co., Syracuse, N. Y.
Delta-Star Electric Co., Chicago.
J. Lang Electric Co., Chicago.
Metropolitan Elec. Mfg. Co., Long Island City, N. Y.
Pringle Electric Mfg. Co., Philadelphia, Pa.

MACHINES, Armature, Forms, Stands, Trucks, Taping Machines, Commutator Slotting Machines.

See also Formers.

Belden Mfg. Co., Chicago. (Magnet Winders.)
Borden Co., Warren, Ohio.
American General Trading Co. New York. "A. G. E."
American Insulating Machinery Co., Philadelphia, Pa.
Chattanooga Armature Works Chattanooga, Tenn. ("Chatarm" Taping Machine.)
Columbia Machine Works & Malleable Iron Co., Brooklyn, N. Y.
Comstock & Co., Wilkes-Barre Pa. (Winding Forms.)
J. P. Devine Co., Buffalo, N. Y. (Impregnating Apparatus.)
Device Improvement Co., Hanover, Pa. ("Peerless" Commutator Slotting Machines.)
Exeter Machine Works, Pittston, Pa. (Winding Forms.)
G. M. Griswold Machine Co., New Haven, Conn. (Taping Machines.)
Railway & Industrial Engineering Co., Pittsburgh, Pa. (Commutator Slotters.)
Frank Ridlon Co., Boston, Mass. "Singer."
Smith & Wallace, Woburn, Mass.

MACHINES, Pipe Threading and Cutting (Motor Driven.)

Borden Co., Warren, Ohio. "Beaver."
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Cox & Sons Co., Bridgeton, N. J.
Crane Co., Chicago, Ill.
The Curtis & Curtis Co., Bridgeport, Conn. "Forbes."
Hoefer Mfg. Co., Freeport, Ill.
Jarecki Mfg. Co., Erie, Pa.
Merrell Mfg. Co., Toledo, Ohio.
Murchey Machine & Tool Co., Detroit, Mich.
D. Saunders' Sons, Yonkers, N. Y.
Standard Engineering Co., Ellwood City, Pa. "Wieland."
Stoever Foundry & Mfg. Co., Myerstown, Pa.
Williams Tool Co., Erie, Pa.

MACHINES, Steel Box Making.

H. Weiss & Co., New York.
Taunton-New Bedford Copper Co., Taunton, Mass.
Worcester Electric & Mfg. Co., Worcester, Mass.

MACHINES, Wire Covering.

See Insulating Machinery.

MACHINE TOOLS, Motor Driven.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Mechanical Appliance Co., Milwaukee, Wis.

MAGNETIC SWITCH CONTROLLERS (for large motors.)

Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co. Cleveland, O.
General Electric Co., Schenectady, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Sundh Electric Co., New York.

MAGNETOS, MAGNETO-GENERATORS AND BELLS.

Manhattan Electrical Supply Co., New York.
Menominee Elec. Mfg. Co., Menominee, Mich.
Schwarze Electric Co., Adrian, Mich.
Western Electric Co., New York.
Acme Tel. & Mfg. Co., Albia, Iowa.

American Electric Co., Chicago, Ill.
J. Andrae & Sons Co., Milwaukee, Wis.
Century Tel. Const. Co., Buffalo, N. Y.
Connecticut Telephone & Electric Co., Meriden, Conn.
Dean Electric Co., Elyria, Ohio.
De Veau Telephone Mfg. Co., Brooklyn, N. Y.
Holtzer-Cabot Electric Co., Brookline, Mass.
Kellogg Switchboard & Supply Co., Chicago, Ill.
Monarch Tel. Mfg. Co., Chicago, Ill.
Standard Tel. Mfg. Co., Portsmouth, Ohio.
Sumter Telephone Mfg. Co., Sumter, S. C. "Mason."
Utica Fire Alarm Teleg. Co., Utica, N. Y.
Western Telephone Mfg. Co., Chicago, Ill.

MAGNET WINDERS.
See Winders. Magnet.

MAGNETO BELLS.
See Generators.

MAGNETOS, Ignition.
General Electric Co., Schenectady.
Manhattan Electrical Supply Co., New York.
American Coil Co., Foxboro, Mass. "Little Wonder."
Apple Electric Co., Dayton, Ohio "Apico."
Bosch Magneto Co., New York. (Importers.)
J. S. Brotz Mfg. Co., New York, "U. & H."
Carlisle & Finch Co., Cincinnati, Ohio.
Albert Champion Co., Boston, Mass. "Gianoli."
Connecticut Telephone & Electric Co., Meriden, Conn.
D. K. Electric Co., St. Louis, Mo. "Duncan."
Dayton Electrical Mfg. Co., Dayton, Ohio. "Apple."
Dow Mfg. Co., Braintree, Mass. "Komet."
Eisemann Magneto Co., New York.
Elbridge Electrical Mfg. Co., Elbridge, N. Y.
Goodson Electric Ignition Co., Providence, R. I.
Heinze Elec. Co., Lowell, Mass.
Henricks Novelty Co., Indianapolis, Ind. "Eureka."
Hercules Electric Co., Indianapolis, Ind. "Wizard."
Hess-Bright Mfg. Co., Philadelphia, Pa.
Holtzer-Cabot Electric Co., Brookline, Mass.
Igniter Appliance Co., Cleveland, Ohio.
K. W. Ignition Co., Cleveland, Ohio.
Kendrick & Davis Co., Lebanon, N. H.
Kent Mfg. Co., Atwater, Philadelphia, Pa.
Knoblock-Heideman Mfg. Co., South Bend, Ind.
Know-Dickey Telephone Mfg. Co., Portsmouth, Ohio.
Lutz-Lockwood Mfg. Co., Roselle, N. J. "SX."
Marine Launch Igniting Co., Watkins, N. Y. "A. B. C."
Maxity-Sleeper Co., Fowler, Ind.
Motsinger Device Mfg. Co., Lafayette, Ind. "Auto-Sparker."
Osburn Electric Co., Chicago, Ill.
Perfection Magneto Co., Anderson, Ind.
Pittsfield Spark Coil Co., Pittsfield, Mass.
Remy Electric Co., Anderson, Ind.
Reppell Electric Co., Kansas City, Mo.
Schug Electric Mfg. Co., Detroit.
C. F. Splitdorf, New York.
Standard Motor Construction Co., Jersey City, N. J.
Stecker Elec. & Machine Co., Detroit, Mich.
Swiss Magneto Co., Chicago, Ill. (Importers "Swiss-Kamet.")
Tritt Electric Co., Union City, Ind. "Vim," "Peerless."
Vesta Accumulator Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill. "Milton."
Whelchel Electric Co., Anderson, Ind.
Witherbee Igniter Co., Springfield, Mass. "Volta."

MAGNETS, Electro.
Belden Mfg. Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady.
Independent Electric Mfg. Co., Milwaukee, Wis.
Manhattan Electrical Supply Co., New York.
Sundh Electric Co., New York.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Acme Wire Co., New Haven, Conn.
Automatic Electric Co., Chicago.
J. H. Bunnell & Co., New York.
Knoblock-Heideman Mfg. Co., South Bend, Ind.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Queen-Gray Co., Philadelphia, Pa.
C. F. Splitdorf, New York.
Thordarsen Electric Mfg. Co., Chicago, Ill.

MAGNETS, Lifting.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, Ohio.
Independent Electric Mfg. Co., Milwaukee, Wis.
Sundh Electric Co., New York.
Western Electric Co., New York.
Browning Engineering Co., Cleveland, Ohio.
Lincoln Electric Co., Cleveland, Ohio.
Pawling & Harnischfeger Co., Milwaukee, Wis.

MAGNETS, Permanent.
Western Electric Co., New York.
Automatic Electric Co., Chicago.
Boker & Co., Hermann, New York, N. Y. (Importers.)
Edward E. Cary Co., New York. (Importers.)
Esterline Co., Lafayette, Ind.
Queen-Gray Co., Philadelphia, Pa.
Utica Fire Alarm Teleg. Co., Utica, N. Y.

MANGANESE.
See Chemicals.

MARBLE, Switchboard.
De Paoli Mosaic Association, Boston, Mass.
Evans Marble Co., Baltimore, Md.
A. Klaber & Son, Long Island City, N. Y.
McNamara Bros., Fair Haven, Vt.
Wm. H. Pelkey, Fair Haven, Vt.
Rutland Marble Mfg. Co., Rutland, Vt.
Vermont Marble Co., Proctor, Vt.

MARINE FIXTURES.
Benjamin Electric Mfg. Co., Chicago, Ill. (Outlet Box.)
Electric Appliance Co., Chicago, Ill. (Waterproof Receptacles.)
General Electric Co., Schenectady.
American Electrical Supply Co., Chicago, Ill. (Sole Selling Agents "Newgard" Waterproof Receptacle.)
Barre & Co., Joseph, New York.
James F. Burns, Philadelphia, Pa. ("V. V." Waterproof Snap Switch Attachments and Globe Caps.)
Crouse-Hinds Co., Syracuse, N. Y. ("Condulet" Waterproof Receptacle.)
Delta-Star Electric Co., Chicago.
C. D. Durkee & Co., New York.
Lovell & Co., F. H., Arlington, N. J.
Lovell-McConnell Mfg. Co., Newark, N. J.
Porter Co., New York.
Edro Richardson Brass Co., Baltimore, Md.
Russell & Stoll Co., New York.
Seidler-Miner Electric Co., Detroit, Mich. "Conditype."
Universal Standard Electric Co., Brooklyn, N. Y.
Yonkers Electric Mfg. Co., Yonkers, N. Y. (Watertight Switch Box.)

MARINE SIGNALS.
See Signals.

MASSAGE VIBRATORS.
See Vibrators.

MAST ARMS.
Brady Electric Mfg. Co., New Britain, Conn.
Geo. Cutter Co., South Bend, Ind.
Fort Wayne Electric Works, Fort Wayne, Ind.
Line Material Co., So. Milwaukee, Wis.
Philadelphia Electrical Mfg. Co., Philadelphia, Pa.
Buffalo Specialty Co., Buffalo.
Electric Railway Equipment Co., Cincinnati, Ohio.
Fletcher Mfg. Co., Dayton, Ohio.
Lundin Elec. & Mach. Co., Boston, Mass. "Philbrick."
Pittsburgh Transformer Co., Pittsburgh, Pa.
C. W. Walls & Co., Worcester, Mass.

MATTING, Burglar Alarm.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.

MATTING, INSULATING.
Massachusetts Chemical Co., Walpole, Mass.
New York Belting & Packing Co., New York.

MEASURING MACHINES (For Wire Measuring.)
Minneapolis Electric & Construction Co., Minneapolis, Minn.
New England Butt Co., Providence, R. I.
Frank Mossberg Co., Attleboro, Mass.
J. J. Waldman, New York.

MEAT CHOPPERS, Electric.
Brecht Co., St. Louis, Mo.
Cincinnati Butchers' Supply Co., Cincinnati, Ohio. "Boss."
Cleveland Meat Chopper Co., Cleveland, Ohio.
Computing Scale Co., Dayton, Ohio. "Dayton" Electric Meat Slicer.
Computing Scale & Fixture Co., Cincinnati, Ohio.
A. J. Deer Co., Inc., Hornell, N. Y. "Royal."
Enterprise Mfg. Co., Philadelphia, Pa.
Hobart Electric Mfg. Co., Troy, Ohio.
B. C. Holwick, Canton, Ohio.
Milwaukee Mfg. Co., Milwaukee.
Pan Electric Mfg. Co., St. Louis.
John E. Smith's Sons Co., Buffalo, N. Y. "Buffalo Silent."
Steiner Mfg. Co., St. Louis, Mo.
Stimpson Mercantile Equipment Co., Northville, Mich. "Peerless."
U. S. Slicing Machine Co., Chicago, Ill.

MEDICAL APPARATUS, Surgical, Dental, Therapeutical, Static Machines.
Campbell Electric Co., Lynn, Mass.
Sanax Co., Inc., New York.
W. D. Allison Co., Indianapolis, Ind. (Physicians' & Surgeons' Supplies.)
Anderson, Norden & Co., Chicago, Ill. ("Nelson" Static Machine.)
Baker Electric Co., Hartford, Conn. (Static Machines.)
Birtman Electric Co., Chicago, Ill. ("Colonial" Static Machine.)
F. W. Braun, Los Angeles, Cal. (Centrifuge.)
Coates Clipper Mfg. Co., Worcester, Mass. (Motor and Flexible Cable Outfits for Dental Purposes.)
Electro-Dental Mfg. Co., Philadelphia, Pa. (Dental Appliances.)
Electro Importing Co., New York. (Static Machines.)
Electro Surgical Instrument Co., Rochester, N. Y.
H. P. Engeln & Co., Cleveland, Ohio.
A. W. Fenner Co., Providence, R. I. (Physicians' and Surgeons' Instruments.)
Good Health Publishing Co., Battle Creek, Mich. (Bath Cabinet.)
Howard Co., Canton, Ohio. ("Gerhard" Dental Appliances.)
J. W. Hughes Co., New York. (Physicians' & Surgeons' Supplies.)
Hutchison Acoustic Co., New York. (Acousticons for the deaf.)
International Instrument Co., Cambridge, Mass. (Centrifuge.)
Kendrick & Davis Co., Lebanon, N. H. (Household Medical Coils.)
Keystone Electric Co., Philadelphia, Pa.
L. E. Knott Apparatus Co., Boston, Mass. (Static Machines.)
Kny-Scheerer Co., New York.
Leucodescent Co., Chicago, Ill., "Clark's" Leucodescent Lamp.
Lindstrom-Smith Co., Chicago, Ill. ("White Cross" Medical Transformer for Incandescent Circuits.)
D. P. McElliot, Chicago, Ill. (Static Machines.)
McIntosh Battery & Optical Co., Chicago, Ill. (Physicians' & Surgeons' Supplies.)
Macalaster Wiggin Co., Boston, Mass. (Switch for Automatically Timing Electric Currents.)
Wm. Meyer Co., Chicago, Ill.
Meyrowitz Mfg. Co., New York. (Physicians' & Surgeons' Supplies.)
Midgley's Radiodescent Lamp Co., Kalamazoo, Mich. ("20th Century" Ultra Violet Ray Lamp.)
Noel Armstrong Co., Akron, O. (Physicians' & Surgeons' Supplies.)
Pelton & Crane Co., Detroit, Mich. (Sterilizers, Gold Annealers, Cautery Outfits and Dentists' Lamps.)
Queen-Gray Co., Philadelphia, Pa.
Ritter Dental Mfg. Co., Rochester, N. Y. ("Columbia" Dental Appliances.)
Scheidel-Western X-Ray Coil Co., Chicago, Ill. (Static Machines.)
Shedd Electric Co., Roselle Park, N. J. (Centrifuge.)
Shelton Electric Co., New York. (Therapeutic Vibrators, Centrifuges.)
Todd Electric Mfg. Co., Meriden, Conn. (Static Machines.)
Van Houten & TenBroeck Co., New York (Physicians' & Surgeons' Supplies.)
Victor Electric Co., Chicago, Ill.
Wappler Electric Mfg. Co., Inc., New York.
Varwig Mfg. Co., Cincinnati, Ohio. (Physicians' Air Pump.)
Waite & Bartlett Mfg. Co., New York. (Physicians' & Surgeons' Supplies.)
S. S. White Dental Mfg. Co., Philadelphia, Pa. (Dental Appliances.)

MESSENGER HANGERS.
Frank B. Cook, Chicago, Ill.
Hallett Iron Works, Chicago, Ill.

METAL, Electrical Sheets—Iron and Steel.
American Sheet & Tin Plate Co., Pittsburgh. (Pole-face Sheets, Armature Sheets), Roofing and Siding Sheets, Roofing Tin, Special Sheets, Black Sheets, Galvanized Sheets, Tin and Terne Plates.

METAL SPINNINGS. See Spinnings.

METAL FINISH, for Refinishing Fixtures.
Gun Metal Finish Co., Decatur, Ill.

METER COVERS, Glass.
Haskins Glass Co., Wheeling, W. Va.

METERS, Recording.
Bristol Co., Bridgeport, Conn.
General Electric Co., Schenectady, N. Y.
Sangamo Electric Co., Springfield, Ill.
Esterline Co., Lafayette, Ind.

METERS, Gas, Electrically operated.
Cutler-Hammer Mfg. Co., Milwaukee, Wis. "Thomas".

METERS, Integrating. See Wattmeters.

METERS, REGISTERS AND TOLL BOXES, Telephones.
American Electric Co., Chicago, Ill. "National".
Baird Electric Co., Chicago, Ill.
Gray Telephone Pay Station Co., Hartford, Conn.
Telechronometer Co., Rochester, N. Y.
Turner Brass Works, Sycamore, Ill. "Telometer".

MICA.
Chicago Mica Co., Valparaiso, Ind. "Micabond".
Johns-Manville Co., H. W., New York.
Mica Insulator Co., New York.
Mitchell-Rand Mfg. Co., New York.
Eugene Munsell & Co., New York.
American Mica Co., Newton, Lower Falls, Mass. "Micabeston".
Asheville Mica Co., Asheville, N. C.
J. E. Burleson Mica Co., Spruce Pine, N. C.
Fitzgibbon Mica Co., Beverly, Mass.
Great Southern Mica Co., Asheville, N. C.
Meirowsky Bros., New York. "Excelsior", "Royal Megohmite".
Monarch Standard Mica Mining Co., New York.
Plas-Mica Co., Yonkers, N. Y.
Robert K. Preston Co., Chicago.
A. O. Schoonmaker Co., New York.
Tar Heel Mica Co., Plumtree, N. C.
United Mica Co., J. H. Parker, Sales Agt., Boston, Mass.
U. S. Mica Co., Chicago, Ill.
Watson Bros., Boston, Mass.

MILKING MACHINES.
See Dairy Apparatus.

MILLS, COFFEE (Electrically Driven).
Coles Mfg. Co., Philadelphia, Pa.
Computing Scales & Fixture Co., Cincinnati, Ohio.

A. J. Deer Co., Inc., Hornell, N. Y. "Royal".
Enterprise Mfg. Co., Philadelphia, Pa.
Hobart Electric Mfg. Co., Troy, Ohio.
B. C. Holwick, Canton, Ohio.
Howe Scale Co., Rutland, Vt.
Stimpson Mercantile Equipment Co., Northville, Mich. "Peerless".

MINERAL WOOL.
Columbia Mineral Wool Co., South Milwaukee, Wis.
United States Mineral Wool Co., New York.

MINIATURE LAMPS. See Lamps, Incandescent, Miniature.

MINING MACHINERY (Motor Driven).
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
American Rotary Tunnel Machine & Development Co., Denver, Colo. ("Sigaboon" Tunneling Machine.)
Christmas Electric Co., Wilkinsburg, Pa. (Coal.)
Economy Machinery Co., Denver, Colo. ("Diets" Air-electric Rock Drills.)
Goodman Mfg. Co., Chicago, Ill.
Ingersoll-Rand Co., New York. ("Electric Air" Channeling Machines for Quarries.)
Jeffrey Mfg. Co., Columbus, Ohio.
Morgan-Gardner Electric Co., Chicago, Ill.
Pneumelectric Machine Co., Syracuse, N. Y. (Coal Punchers.)
Sullivan Machinery Co., Chicago, Ill.

MIRRORS, Shaving.
Federal Sign System, (Electric), Chicago.
Franks Mfg. Co., Rock Island, Ill.

MITERS. For Cutting Moulding.
Smith & Hemenway Co., New York.
J. M. Seymour, Jr., Newark, N. J.

MIXERS, Drink.
Hamilton-Beach Mfg. Co., Racine, Wis. "Cyclone".
Fulton-Bell Co., New York. "U-See-Us", "Cyclone".
Shelton Elec. Co., Chicago.

MOTORS, Automobile.
General Electric Co., Schenectady, N. Y.
Wagner Electric Mfg. Co., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Lincoln Electric Co., Cleveland, Ohio.

MOTORS AND DYNAMOS.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Archer & Baldwin, New York.
Central Electric Co., Chicago, Ill.
Century Electric Co., St. Louis, Mo.
Colonial Fan & Motor Co., Warren, Ohio.
Crocker-Wheeler Co., Ampere, N. J.
Diehl Mfg. Co., Elizabethport, N. J.
Eck Dynamo & Motor Co., Belleville, N. J.
Electric Machinery Co., Minneapolis, Minn.
Emerson Electric Mfg. Co., St. Louis, Mo.
Fort Wayne Electric Works, Ft. Wayne, Ind. "Northern", "Weed".
General Electric Co., Schenectady.
Hamilton-Beach Mfg. Co., Racine, Wis.
Mechanical Appliance Co., Milwaukee, Wis. "R. T.", "Watson".
Peerless Electric Co., Warren, Ohio.
Richmond Electric Co., Richmond Va.
Ridgway Dynamo & Engine Co., Ridgway, Pa. "Thompson-Ryan".
Robbins & Myers Co., Springfield, Ohio. "Standard".
Sprague Electric Works, New York. "Lundell".
Triumph Electric Co., Cincinnati.
Wagner Electric Mfg. Co., St. Louis, Mo.
Western Electric Co., New York. "Hawthorn".
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Aaron Electric Co., Chicago, Ill.
Advance Electric Co., St. Louis, Mo. (Small A. C. Motors.)
Allen Electric Co., Chicago, Ill.
American Engine Co., Bound Brook, N. J.
American Rotary Valve Co., Chicago, Ill. "Jenney".
Barnes Mfg. Co., Susquehanna, Pa. (Small Motors.)
D. L. Bates & Bro. Co., Dayton, Ohio ("Imperial.")
Bell Electric Motor Co., New York, N. Y.
Benton Electric Co., La Crosse, Wis.
Birtman Electric Co., Chicago, Ill. ("Bee" Small Motors.)
Bissell Motor Co., Toledo, Ohio. (Sewing Machine Motors.)
Bodine Electric Co., Chicago, Ill. (Dental Motors and Grinders.)
C. J. Bogue Electric Co., New York.
Burke Electric Co., Erie, Pa.
C. & C. Electric & Mfg. Co., Garwood, N. J.
The Carleton Co., Boston, Mass.
Jas. Clark, Jr., Elec. Co., Louisville, Ky. "Willey".
Cleveland Armature Works, Cleveland, Ohio.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Cushman Electric Co., Concord, N. H.
A. J. Deer Co., Inc., Hornell, N. Y.
Dienelt & Eisenhardt, Philadelphia, Pa.
Dover Electric Mfg. Co., Canal Dover, Ohio.
Eager Electric Co., Watertown, N. Y.
Elbridge Elecl. Mfg. Co., Elbridge, N. Y.
Electric Specialty Co., Stamford, Conn.
Electro-Dynamic Co., Bayonne, N. J.
Engberg's Electric & Mechanical Works, St. Joseph, Mich.
Fairbanks-Morse & Co., Chicago.
Federal Electric Co., North Girard, Pa.
Fidelity Electric Co., Lancaster, Pa. ("Eclipse" Motors.)
Fisher Electrical Works, Detroit, Mich.
Fosberg Motor Works, New York.
Fuller Co., Detroit, Mich.
G. & E. Electric & Construction Co., Binghamton, N. Y.
Globe Electric Co., Chicago, Ill.
Green Electric Co., W., New York.
Hertner Elec. & Mfg. Co., Cleveland, Ohio.
Holtzer-Cabot Electric Co., Brookline, Mass.
Holt Elec. Co., Milwaukee, Wis.
Horn Electric Co., Chicago, Ill. (Motors.)
Ideal Electric & Mfg. Co., Mansfield, Ohio.
Imperial Electric Co., Akron, Ohio.
Jantz & Leist Elec. Co., Cincinnati, Ohio.
James Jones Co., Los Angeles, Cal. (Small.)
Kelley Electric Machine Co., Buffalo, N. Y.
Kentucky Electrical Co., Owensboro, Ky.
Kester Electric Co., Terre Haute, Ind.
Kimball Electric Co., Chicago, Ill.
Kurz & Root, Appleton, Wis.
Lamb Elec. Co., Grand Rapids, Mich.
Lanigan & Rosemont Elec. Co., New York. (Small Motors.)
Lincoln Electric Co., Cleveland, Ohio.
McCarthy Bros. & Ford, Buffalo.
Morgan-Gardner Electric Co., Chicago, Ill.
Northwestern Mfg. Co., Milwaukee, Wis.
Olson-Boettger Elec. Mfg. Co., St. Paul, Minn. (Small.)
Pan Electric Mfg. Co., St. Louis, Mo. "Chandeysson".
Phoenix Elec. Co., Mansfield, Ohio.
Power Electric Co., Canton, Ohio.
Reliance Elec. & Engng. Co., Cleveland, Ohio.
Rochester Electric Motor Co., Rochester, N. Y. "Service".
Rossmasseler-Bonine Elec. Co., Philadelphia, Pa.
Roth Bros. & Co., Chicago, Ill.
Shedd Electric Co., Roselle Park, N. J.
Star Dynamo Co., Jefferson City, Mo.
Steiner Mfg. Co., St. Louis, Mo.
Stow Mfg. Co., Binghamton, N. Y. (Polishers and Buffers.)
Sturtevant Co., Hyde Park, Mass.
Swing Elec. Co., Cincinnati, Ohio. "Barriett".
Troy Electrical Co., Troy, N. Y.
U. S. Electrical Mfg. Co., Los Angeles, Cal. "Usemco".
Victor Electric Co., Chicago, Ill. (Small.)
Virginia Electric & Machine Works, Charleston-Kanawha, W. Va.
Joseph Weidenhoff, Chicago, Ill. (Small Motors.)

MOTORS, BATTERY. Battery Motors, Battery Fans, Toy Motors.
Manhattan Electrical Supply Co., New York.
Menominee Electric Mfg. Co., Menominee, Mich.
H. L. Rittenhouse Co., Scranton, Pa.
Acme Telephone & Mfg. Co., Albia, Iowa. (Fans.)
Carlisle & Finch Co., Cincinnati.
The Carleton Co., Boston, Mass.
Commercial Electrical Co., Kewanee, Ill.
Elbridge Elecl. Mfg. Co., Elbridge, N. Y.
Industrial Novelty Co., Chicago.
Ithaca Electric Novelty Co., Ithaca, N. Y. "Rienco".
Kenrick & Davis Co., Lebanon, N. H.
Knapp Electric & Novelty Co., New York. "Kenco", "Little Hustler".
Lionel Mfg. Co., New York. "New Departure".
Pennsylvania Storage Battery Co., Philadelphia, Pa. ("Richmond" Fan.)
Portable Battery & Fan Co., Philadelphia, Pa.
Henry R. Swope, Philadelphia, Pa. "Keystone", "H. R. S."
Trembly Elec. Co., Centerville, Iowa.
Voltamp Electric Mfg. Co., Baltimore, Md.

MOULDING FITTINGS.
Jordan Bros., New York. (Splice Protectors Only.)
National Metal Molding Co., Pittsburgh, Pa.
H. T. Paiste Co., Philadelphia, Pa. "P. K. Taplets".
Stanley & Patterson, New York.
Trumbull Electric Mfg. Co., Plainville, Conn. ("H. & M." Branch Blocks.)
Wm. H. Colgan Co., West Newton, Mass.
Fancieve Specialty Co., Jamaica Plain, Mass.
Gillette-Vibber Co., New London, Conn.

MOULDING, Metallic.
National Metal Molding Co., Pittsburgh, Pa.
American Circular Loom Co., Boston, Mass. "Lutz".

MOULDINGS, Wood.
American Hardware Mfg. Co., Grottoes, Va.
Central Mfg. Co., Chattanooga, Tenn.
Foley Mfg. Co., Chicago, Ill.
Kirkpatrick Mfg. Co., Philadelphia, Pa. "Hold Wire", "Simplex".
Mitchell Moulding Co., Chicago, Ill. "Wire Grip".
Plannett Lumber & Mfg. Co., La Porte, Ind.
J. M. Saulpaugh's Sons, New York.
Henry H. Sheip Mfg. Co., Philadelphia, Pa.
Thornton & Co., Holland, Mich.
Wright & Craycroft, Chicago.

MOUTHPIECES, Glass.
American Electric Co., Chicago. "Germproof".
Gibson Mfg. Co., Danbury, Conn.
Maxim Specialty Co., New York.
J. S. Schneider Co., Ridgefield, Conn.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.

MOUTHPIECES, Rubber or Composition. See also Insulation, Molded.
S & M Electric Co., Chicago, (Whispering Mouthpieces.)

NAILS, Rubber Head.
Elastic Tip Co., Boston, Mass.

NETS AND GUARDS, Arc Lamp.
Hamblin & Russell Mfg. Co., Worcester, Mass. "Never Break".
Morse, Frank W., Boston, Mass.

NEUTRALIZERS, Static Charge. (For Printers and Textile Manufacturers.)
Chapman Electric Neutralizer Co., Portland, Me.

NIPPLES. See Couplings.

NOVELTIES. See Toys, also Motors, Battery.

NUMBERS, Automobile License, Electric Illuminated.
Atlas Stamping Co., Chicago, Ill.
Holt & Beubee Co., Boston.
Peerless Head & Tail Light Co., Chicago, Ill.

NUT LOCKS. See Bushings.

OFFICE ACCESSORIES. (Motor Driven.)
Vote-Berger Co., La Crosse, Wis. (Duplicating Machines.)
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. (Eraser for Draughtsmen.)
American Cash Register Co., Columbus, Ohio.
American Graphophone Co., Bridgeport, Conn.
American Multigraph Co., Cleveland, Ohio.
Automatic Coinwrapping Machine Co., New York.
Blickensderfer Mfg. Co., Stamford, Conn. (Typewriters.)
Bowes Envelope Sealer Co., Pittsburgh, Pa.
Burroughs Adding Machine Co., Detroit, Mich. (Adding Machines.)
Coates Clipper Mfg. Co., Worcester, Mass. (Erasers.)
Comptograph Co., Chicago, Ill. (Adding and Listing Machines.)
A. & B. Dick Co., Chicago, Ill. (Letter and Circular Folders.)
Elliott Addressing Machine Co., Cambridge, Mass.
Flexotype Co., Burlington, N. J.
Gray Nat'l Telautograph Co., New York. (Telautographs.)
Mailometer Co., Chicago, Ill. (Letter Sealers, Counters and Stampers.)
Montague Mailing Machinery Co., Chattanooga, Tenn. (Addressing Machines.)
Meacham Addressing Machine Co., New York.
National Cash Register Co., Dayton, Ohio. (Cash Registers.)
National Dictograph Co., Jamaica, N. Y. (Dictograph.)
National Folding Machine Co., Sidney, Ohio. (Letter and Circular Folders.)
Neostyle Co., New York. (Duplicating Apparatus.)
Pike Adding Machine Co., Orange, N. J.
Rapid Addressing Machine Co., New York. (Addressing Machines.)
Roneo Co., New York. (Copying Machine.)
W. Sparks, New York. (Desk Punches.)
Stromberg Electric Co., Chicago, Ill. "Chronograph".
Tabulating Machine Co., Washington, D. C.
U. S. Printograph Co., La Crosse, Wis.
Universal Adding Machine Co., St. Louis, Mo. (Adding Machines.)
Velox Co., New York. (Addressing Machines.)
Victor Talking Machine Co., Camden, N. J. "Auxetphone".
Yawman & Erbe Mfg. Co., Rochester, N. Y. (Labeling Machines and Letter Copiers.)

OHMMETERS. See Instruments, Testing.

OIL ENGINES. See Engines.

OIL FILTERS. See Filters, Oil.

OIL FLOW INDICATORS AND METERS.
Chemelectric Co., Chicago.

OIL FUSE BOXES. See Boxes, Oil.

OIL, Lubricating.
Chas. F. Kellom & Co., Philadelphia. ("Invader").
New York & New Jersey Lubricant Co., New York. "Non-Fluid Oil".

OPENERS AND LOCKS, Door. See Door Openers and Locks.

ORGAN BLOWERS. See Blowers, Organ.

OSCILLATORS, Fan. See Deflectors.

OUTFITS, Automobile Lighting. See Automobile Lighting Outfits.

OUTLET BOXES. See Boxes, Conduit.

OUTRIGGERS, Arc Lamp. See Brackets.

OVENS. See Cooking Devices.

OZONATORS AND AIR PURIFIERS.
Federal Sign System, (Electric), Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Julius Andrae & Sons Co., Milwaukee, Wis. (Submerged Lamps, Hygro-Electric Moistener.)
Carrier Air Conditioning Co., New York, N. Y.
S. W. Cramer Co., Charlotte, N. C. (Air Purifying Apparatus.)
Duntley Mfg. Co., Chicago, Ill. (Air Purifier.)
Fries, J. W., Winston-Salem, N. C. "Hygrosse," "Clean-Air."
Kauffman Heating & Mfg. Co., St. Louis. "Kinealy."
McCreery Engrng. Co., Toledo, O.
Ozone Pure Airifier Co., Chicago, Ill. (Ozone Apparatus.)
Ozonizer Co., Chicago, Ill.
Standard Electro Utilities Co., Chicago, Ill. "Vohr".
Thomas & Smith, Chicago, Ill. (Air Purifying Apparatus.)
Warren Webster & Co., Camden, N. J.

PACKING, STEAM.
B. F. Goodrich Co., Akron, Ohio. "Superheat".
H. W. Johns-Manville Co., New York.
New York Insulated Wire Co., New York. "Lightning Non-Tubular".
American Goetze Gasket & Packing Co., New Brunswick, N. J.
A. W. Chesterton Co., Boston, Mass. "Metalbestos."
Clifton Mfg. Co., Jamaica Plain, Mass.
Eureka Packing Co., New York.
Garlock Packing Co., New York.
Jenkins Bros., New York.
McCord Mfg. Co., Detroit, Mich.
Peerless Rubber Mfg. Co., New York. "Success", "Germane", "Honest John", "Hercules", "Uniphite", "Rainbow", "Arctic", "Zero".
Quaker City Rubber Co., Philadelphia. "PPP" Packing.
J. L. Robertson & Sons, New York. "Eureka."
Steel Mill Packing Co., Detroit, Mich. "Safety" Metallic Packing.
U. S. Mineral Wool Co., New York.

PAINTS AND COMPOUNDS, Insulating. See Insulating Paints.

PAINTS, Preservative.
Carbolineum Wood Preserving Co., Milwaukee, Wis.
Joseph Dixon Crucible Co., Jersey City, N. J. "Griphite".
H. W. Johns-Manville Co., New York.
The Standard Paint Co., New York. "Flexite," "P. B.", "P. & B.", "Giant."
Western Electric Co., Chicago.
L. S. Brach Supply Co., New York.
C-A Wood Preserver Co., St. Louis, Mo.
Di-Electric Mfg. Co., St. Louis, Mo. "Petroite," "Phenoleum."
Flintkote Mfg. Co., New York, N. Y. "Rex No. 1, No. 2 and No. 1 Red."
German Importing Co., Chicago, "Hy-Boil-Oil."
Massachusetts Chemical Co., Walpole, Mass. "M. C."
Massachusetts Varnish Works, New York. "W. P."
Sterling Varnish Co., Pittsburgh.
Wyckoff Pipe & Creosoting Co., Portsmouth, Va.

PANEL BOARDS. See Switchboards.

PAPER, Insulating Paper, Fuller Board, Press Board.
Chicago Mica Co., Valparaiso, Ind.
American Mica Co., Newton, Lower Falls, Mass. "Puritan."
Carter, Rice & Co., Boston, Mass.
Case Bros., Highland Park, Conn. (Fuller Board.)
Case-Risley Press Paper Co., Oneco, Conn. (Fuller Board.)
Massachusetts Chemical Co., Walpole, Mass. "Neponset".
Merwin Paper Co., Hartford, Conn. **(Fuller Board.)**
Pittsburgh Insulating Co., Pittsburgh, Pa.
E. R. Ramsey Co., Penn Yan, N. Y.
Rogers Paper Mfg. Co., South Manchester, Conn. (Fuller Board.)

PAPER SLEEVES. See Sleeves.

PARAFFINE. See Wax.

PEARL.
Erie Button Works, Erie, Pa.
Independent Button & Machine Co., Chicago.

PEELERS, Vegetable. (Motor Driven.)
Imperial Machine Co., New York. "Victoria".

PENDANTS, Wiring.
Cutter Co., Geo., South Bend, Ind.
Fletcher Mfg. Co., Dayton, Ohio. "Etheridge".

PERMANENT MAGNETS. See Magnets.

PHOTOMETERS, Lamp Testing.
Leeds & Northrup Co., Philadelphia, Pa.
James G. Biddle, Philadelphia, Pa. (Importer "Siemens & Halske".)
Foote, Pierson & Co., New York. "Matthews", "Sharp-Millar".
W. & L. E. Gurley, Troy, N. Y.
Precision Instrument Co., Detroit, Mich.
Queen-Gray Co., **Philadelphia, Pa.**
Thompson-Levering Co., Philadelphia, Pa. "Peerless".

PHOTOMETER STANDARDS.
Electrical Testing Laboratories, New York, N. Y.

PIANO PLAYERS, Electric.
Choralco Mfg. Co., Boston, Mass.
F. Engelhardt & Sons, St. Johnsville, N. Y.
Foster-Armstrong Co., Rochester, N. Y.
Telelectric Co., Pittsfield, Mass.

PIGTAILS AND FLEXIBLE LEADS.
Belden Mfg. Co., Chicago, Ill.
Chas. E. Chapin Co., Inc., New York, N. Y.
Rome Wire Co., Rome, N. Y.
James Goldmark Co., New York, (Sole Selling Agent for New England Electrical Works, Lisbon, N. H.)

PILOT HOUSES. See Houses.

PINIONS. See Gears.

PINS AND BRACKETS. Wood.
American Cross-Arm Co., Chicago.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
F. Bissell Co., Toledo, Ohio.
Electrical Engineers Equipment Co., Chicago, Ill. (Pipe Clamp Pins.)
Mineralac Electric Co., Chicago. "Unity" Insulator and Pin.
Wm. Mueller & Co., Chicago.
W. M. Absher Co., North Wilkesboro, N. C.
Clarence Call, North Wilkesboro, N. C.
W. R. Carmichael, Ravenswood, W. Va.
Central Mfg. Co., Chattanooga.
Central Telephone & Electric Co., St. Louis, Mo. "Bois De Arc."
Cohn & Bock Co., Princess Anne, Md.
Cottage Planing Mill Co., Everett, Pa.
Elkin Machinery Co., Elkin, N. C.
B. F. & R. P. Gravely, Martinsville, Va.
Houston & Liggett, Houston, Texas.
Kapp & Miller Co., Rural Hall, N. C.
Kettle River Co., Minneapolis.
Locust Pin Co., Front Royal, Va.
H. Marcus, Muscoda, Wis.
National Electrical Supply Co., Washington, D. C.
Osborne & Son, Camden, N. Y.
Oskosh Mfg. Co., Oshkosh, Wis. (Kalkeen.)
Victor Petertyl, Traverse City, Mich.
Pettingell-Andrews Co., Boston, Mass. (O'Neill Reinforced.)
Philadelphia Electric Mfg. Co., Philadelphia, Pa.
Pilliod Lumber Co., Swanton, Ohio.
Russell & Stoll Co., New York. (Marine.)
Standard Pin & Bracket Co., Madison, Ind.
B. F. Stevens Stave Co., Martinsville, Ind.
Texas Arm & Pin Co., Beaumont, Texas.
Towers Pin & Bracket Co., Ellijay, Ga.
Trammell Co., Louisville, Ky.
U. S. Bobbin & Shuttle Co., Providence, R. I.
A. S. Wade & Co., Shippensburg, Pa.
Western Lumber & Pole Co., Denver, Colo.

PINS, INSULATOR, IRON. See Brackets, Iron.

PINS, INSULATOR, WOOD.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Mineralac Electric Co., Chicago. "Unity" Insulator and Pin.

PIPE BENDERS. See Benders.

PIPE COVERINGS, STEAM.
American District Steam Co., Lockport, N. Y.
H. W. Johns-Manville Co., New York.

PIPE CUTTING MACHINES. See Machines, Pipe Threading and Cutting.

PIPE ENDS. See Fittings.

PIPE FITTING TOOLS.
Borden Co., Warren, Ohio. "Beaver".
Steel City Electric Co., Pittsburgh, Pa. "Steel City", "Thompson".
Armstrong Mfg. Co., Bridgeport, Conn.
L. S. Brach Supply Co., New York.
Butterfield & Co., Derby Line, Vt.
Curtis & Curtis Co., Bridgeport, Conn.
Eck Tool Co., Chicago, Ill.
Vanderman Mfg. Co., Williamantic, Conn.
Wiley & Russell Mfg. Co., Greenfield, Mass. "Green River."

PIPE HANGERS. See Hangers & Clamps.

PIPE STRAPS. See Hangers & Clamps.

PLANTS, LIGHTING. See Lighting Plants.

PLATES, FLUSH SWITCH.
Machen & Mayer Elec'l Mfg. Co., Philadelphia, Pa. "M. & M."
Central Tel. & Elec. Co., St. Louis, Mo.
F. H. Lovell & Co., Arlington, N. J. "Double Eagle".

PLATFORMS (Pole Seats).
F. Bissell Co., Toledo, Ohio.
Hubbard & Co., Pittsburgh, Pa.
Oshkosh Mfg. Co., Oshkosh, Wis.
Anderson Forge & Mach Co., Detroit, Mich.
Hallett Iron Works, Chicago, Ill.
Kinsey Mfg. Co., Toledo, Ohio.
M. Lanz & Sons, Pittsburgh, Pa.
Fred L. Meeckel, Chicago, Ill.
North Penn Iron Co., Philadelphia, Pa.

PLATINUM.
American Platinum Works, Newark, N. J.
Baker & Co., Inc., Newark, N. J.
J. Bishop & Co., Malvern, Pa.
Commercial Research Co., Tuckahoe, N. Y. (Platinum headed rivets.)
Thos. J. Dee & Co., Chicago, Ill.
Goldsmith Bros. Smelting & Refining Co., Chicago, Ill.
C. S. Platt, New York.
Roessler & Hasslacher Chemical Co., New York.
Jas. Schawel & Co., New York.
Emil Schneider, Inc., Newark, N. J.

PLIERS, Wire Cutting.
Arrow Electric Co., Hartford, Conn. "Economy."
H. W. Johns-Manville Co., New York. (Insulated Handles.)
Mathias Klein & Sons, Chicago, Ill., "Goehst".
Smith & Hemenway Co., New York.
Bergman Tool Mfg. Co., Buffalo, N. Y. "B. B."
Billings & Spencer Co., Hartford, Conn.
C. E. Bonner Mfg. Co., Champaign, Ill. "Victor".
Bryant Electric Co., Bridgeport, Conn.
Cincinnati Tool Co., Cincinnati, Ohio. "Hargrave".
Crescent Tool Co., Jamestown, N. Y.
Cronk & Carrier Mfg. Co., Elmira, N. Y.
Dicke Tool Co., Downers Grove, Ill.
Erie Tool Works, Erie, Pa.
Industrial Novelty Co. Chicago, Ill. (Importers.)
Kilborn & Bishop Co., New Haven, Conn.
Montgomery & Co., New York. (Importers.)
C. S. Osborne & Co., Newark, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
H. K. Porter, Everett, Mass. "Boston."
Reed Mfg. Co., Erie, Pa.
Wm. Schollhorn Co., New Haven, Conn. "Bernard's".
Schuchardt & Schutte, New York. (Importers "Lindstrom", "S. & S.")
Utica Drop Forge & Tool Co., Utica, N. Y.
Vom Cleff & Co., New York. (Importers of Frye's Patent Splicing Pliers.)
Whitaker Mfg. Co., Chicago, Ill.

PLUG CUT-OUTS. See Cut-Outs.

PLUGS, Attachment. (See Attachment Plugs.)

PLUGS, Extension.
Phelps Mfg. Co., Detroit, Mich.

PLUGS, Fuse. (See Fuse Plugs.)

PLUGS AND RECEPTACLES, Battery Charging.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
General Electric Co., Schenectady.
Delta-Star Electric Co., Chicago.
Russell & Stoll Co., New York.

PLUGS AND RECEPTACLES, Flush.
Arrow Electric Co., Hartford, Conn.
Chelten Elec. Co., Philadelphia.
General Electric Co., Schenectady.
Hart Mfg. Co., Hartford, Conn. "Diamond H".
Machen & Mayer Elec'l Mfg. Co., Philadelphia, Pa. ("M. & M." Standard Indicating Heater Receptacles.)
Manhattan Electrical Supply Co., New York. "Mesco".
H. T. Paiste Co., Philadelphia, Pa. "Fielding."
Trumbull Electric Mfg. Co., Plainville, Conn.
Bryant Electric Co., Bridgeport, Conn. ("Chapman" and "Ruby" Sign Receptacle.)
Chicago Electric Mfg. Co., Chicago, Ill. "Handy".
Hart & Hegeman Mfg. Co., Hartford, Conn. "H. & H."
Harvey Hubbell, Inc., Bridgeport, Conn. (Indicating Receptacles.)
Metropolitan Elec. Mfg. Co., Long Island City, N. Y.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Pringle Elecl. Mfg. Co., Philadelphia, Pa.

PLUGS AND RECEPTACLES, Stage.
Frank Adam Electric Co., St. Louis, Mo.
General Electric Co., Schenectady, N. Y. (Double Ended Receptacle.)
Manhattan Electric Supply Co., New York.
Stanley & Patterson, New York, "Fielding".
Universal Electric Stage Lighting Co., New York. "Kliegl".
Western Electric Co., New York.
Chicago Elec. Mfg. Co., Chicago, Ill. ("Handy" Stage Connectors.)
Condit Electrical Mfg. Co., Boston, Mass.
Electric Apparatus Co., Chicago.
Electric Stage Lighting Co., Chicago, Ill.
Globe Electric Specialties Co., New York.
J. Lang Electric Co., Chicago, Ill.
Menchen Elec. Co., Joseph, New York.
Russell & Stoll Co., New York.
Tregoning Electric Mfg. Co., Cleveland, Ohio.

PLUGS, Condit. (Wood.)
C. H. Lever Mfg. Co., Chicago, Ill.
Philadelphia Electrical Mfg. Co., Philadelphia, Pa.
J. C. Wolf, Westville, N. J.

PLUGS, Spark.
Emil Grossman & Co., New York. "Red Head".
Hartford Pump & Mfg. Co., Boston, Mass.
Heinze Elec. Co., Lowell, Mass.
Jeffrey-Dewitt Co., Detroit, Mich. "J. D.", "Reliance", "Edison Double System".
Long Bros., Kokomo, Ind.
C. A. Mezger, New York, "Soot Proof".
Milwaukee Auto Specialty Co., Milwaukee, Wis. "Victor". "Centre Fire".
A. R. Mosler & Co., New York. "Beat-Em-All", "Triumph", "Split-Fire".
Never-Miss Mfg. Co., Lansing, Mich.
New York Mica & Mfg. Co., Auburn, N. Y. "Wright".
Oakes & Dow Co., Boston, Mass. "Sootless", "Comet".
Orswell Ignition Co., Boston, Mass.
Rajah Auto Supply Co., Bloomfield, N. J.
Randall-Faichney Co., Boston, "Bing".
Standard Co., Torrington, Conn. "Breech Block".
Volcano Spark Plug Co., Ashland, Ohio.

PNEUMATIC BRUSHES. See Brushes, Pneumatic, also Dusters.

POCKET METERS. See Gauges, Battery.

POLARITY INDICATORS. See Instruments.

POLE MEASURING INSTRUMENT. See Instruments, Pole Measuring.

POLE PRESERVING MACHINES.
B. and E. Pole Preserving Co., Chicago.
W. F. Goltra Co., Cleveland, O.

POLE ERECTORS.
W. N. Matthews & Bro., St. Louis, Mo.

POLES, Concrete.
American Steel & Wire Co., Chicago, Ill.
American Concrete Pole Co., Richmond, Ind.
J. G. Birtness Sons Co., Davenport, Iowa. (Moulds for making concrete poles.)
Hollow Concrete Pole Co., Oklahoma City, Okla.
New York Pole Co., New York. (Reconstructing Tubular Iron Poles.)
Pettyjohn Co., Terre Haute, Ind. (Columns.)

POLES. Iron and Steel.
Columbia Machine Works & Malleable Iron Co., Brooklyn, N. Y.
Diamond Steel Pole Co., Philadelphia, Pa. (Tapered.)
Electric Railway Equipment Co., Cincinnati, Ohio.
Franklin Steel Co., Franklin, Pa. "Tripartite".
Garford Co., Elyria, Ohio. "Shelby".
National Tube Co., Pittsburgh, Pa.
R. D Nuttall Co., Pittsburgh, Pa.
Philadelphia Elec. & Mfg. Co., Philadelphia, Pa.
Pittsburgh Trolley & Forge Co., Pittsburgh, Pa.
Sectional Steel Pole Co., Minneapolis, Minn. (Sectional.)

POLES, Treated.
Lindsley Bros & Co., Spokane, Wash.
Page & Hill Co., Minneapolis, Minn.
Valentine-Clarke Co., Minneapolis, Minn.
W. F. Goltra Co., Cleveland, O.

POLES, Wood.
F. Bissell Co., Toledo, Ohio.
Bradley Timber & Railway Supply Co., Duluth, Minn.
B. J. Carney & Co., Grinnell, Ia.
Crawford Cedar Co., Menominee, Mich.
L. R. Deal Lumber Co., Des Moines, Ia.
Duluth Log Co., Duluth, Minn.
Lindsley Bros. Co., Spokane, Wash.
Mueller & Co., Wm., Chicago.
National Pole Co., Escanaba, Mich.
Naugle Pole & Tie Co., Chicago.
Page & Hill Co., Minneapolis, Minn.
Partridge Lumber Co., T. M., Minneapolis, Minn.
Sandpoint Lumber & Pole Co., Sandpoint, Idaho.
Sterling & Son Co., W. C., Monroe, Mich.
Torrey Cedar Co., Clintonville, Wis.
Valentine-Clark Co., Minneapolis, Minn.
Western Electric Co., New York.
C. H. Worcester Co., Chicago, Ill.
Bell Lumber Co., Minneapolis, Minn.
Chattanooga Pole Co., Chattanooga, Tenn.
Cherry River Boom & Lumber Co., Richwood, W. Va.
Crescent Lumber Co., Pittsburgh, Pa.
Faris & Mayhew Lumber & Pole Co., Denver, Colo.
John H. Fowler & Co., Chicago.
Holt Lumber Co., Oconto, Wis.
Humbird Lumber Co., Sand Point, Idaho.
Morrison Lumber Co., J. W., Minneapolis, Minn.
Perley Lowe & Co., Chicago, Ill.
Pacific Coast Pole Co., Spokane, Wash.
Paducah Pole & Timber Co., Paducah, Ky.
Pendleton & Gilkey, Minneapolis, Minn.
Southern Exchange Co., Maxton, N. C.
Three States Cedar Co., Minneapolis, Minn.
Western Lumber & Pole Co., Denver, Colo.
Wittenberg Cedar Co., Wittenberg, Wis.

POLES, Trolley.
American Bridge Co., New York.

POLE CHANGERS.
Kellogg Switchboard & Supply Co., Chicago, Ill.
Homer Roberts Telephone Co., Chicago, Ill.
Current Electric Co., Chicago, Ill. "Standard".
Sandwich Mfg. Co., Sandwich, Ill.
Warner Electric Co., Muncie, Ind.

POLE SEATS AND LADDERS. See Platforms.

POLE STEPS.
American Steel & Wire Co., Chicago, Ill.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Cutter Co., Geo., South Bend, Ind. (Removable only.)
Hubbard & Co., Pittsburgh, Pa.
Oshkosh Mfg. Co., Oshkosh, Wis.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Capital Elec. Co., Salt Lake City, Utah. "McBride".
Electric Railway Equipment Co., Cincinnati, Ohio.
Hoopes & Townsend Co., Philadelphia, Pa.
Inland Steel Co., Chicago, Ill.
M. Lanz & Sons, Pittsburgh, Pa.
Michigan Bolt & Nut Works, Detroit, Mich.
Republic Iron & Steel Co., Chicago, Ill.
Rockford Bolt Co., Rockford, Ill.
Strieby & Foote Co., Newark, N. J.
St. Louis Malleable Casting Co., St. Louis, Mo.

POLETOPS, Arc Lamp.
Geo. Cutter Co., South Bend, Ind.
Line Material Co., South Milwaukee, Wis.
Electric Railway Equipment Co., Cincinnati, Ohio.

POLICE SIGNALS. See Fire Alarms.

POLISHERS AND BUFFERS, Motor Driven. (For portable forms, see Tools. Portable.)
Anderson Elec. Machine Tool Co., St. Louis, Mo.
Diamond Machine Co., Providence, R. I.
Heard Machine Co., Worcester, Mass.
Roth Bros. & Co., Chicago, Ill.

POLISHERS, Floor. See Floor Cleaners and Polishers.

POLISHERS, Shoe. (Motor Driven.)
Burkhart Automatic Shoe Polishing Machine Co., Buffalo.
Reason Elec. Automatic Shoe Polishing Machine Co., Pontiac, Mich.

PORCELAIN, Special Shapes.
Findlay Elect. Porcelain Co., Findlay, O.
Pass & Seymour, Inc., Solvay, N. Y.
Artistic Porcelain Co., Trenton, N. J.
Colonial Sign & Insulator Co., Akron, Ohio.
Empire China Works, Brooklyn.
Hartford Faience Co., Hartford, Conn.
Imperial Porcelain Works, Trenton, N. J.
Parker, J. H., Boston, Mass.
Peru Electric Co., Peru, Ind.
Star Porcelain Co., Trenton, N. J.
Thomas & Sons Co., E. Liverpool, Ohio.

PORCELAIN, Standard. (Insulators, Knobs, Cleats, Tubes, Bushings.)
Cook Pottery Co., Trenton, N. J. (Wedge Split Insulators.)
Findlay Electric Porcelain Co., Findlay, O.
General Electric Co., Schenectady, N. Y.
Pass & Seymour, Inc., Solvay, N. Y.
E. H. Pall & Co., Cedar Rapids, Iowa. (Cleats.)
Benbow Co., Cincinnati, Ohio. (Mine Insulators.)
Colonial Sign & Insulator Co., Akron, Ohio. "Murdock" Cleats.
Hartford Faience Co., Hartford, Conn.
Illinois Porcelain Co., Macomb, Ill.
Imperial Porcelain Works, Trenton, N. J. ("Duggan" Cleats.)
Locke Insulator Mfg. Co., Victor, N. Y.
Ohio Brass Co., Mansfield, Ohio. (Mine and Tunnel Insulators, Entrance Tubes.)
Parker, J. H., Boston, Mass. ("Nichols") Insulators and Cleats, "Fenton" Knobs, "Evans" and "B. D." Knobs and Cleats, "Stevens" High Tension Cleats, "N. E." Split Knobs, "Thompson" Corner and Angle Cleats.)
Paragon-Sellers Co., Chicago, Ill. (Self-Tying Knob.)
Peru Electric Co., Peru, Ind.
Snyder-Hunt Co., Belle Plaine, Iowa. (Insulators.) (Cleats and Knobs.)
Star Porcelain Co., Trenton, N. J.
Thomas & Sons, R., E. Liverpool, Ohio.
Union Porcelain Works, Brooklyn, N. Y.
Universal Specialty Co., Terre Haute, Ind. (Special Insulators.)
Weber Elec. Co. (Henry D. Sears, Gen'l Sales Agt., 131 State St., Boston, Mass.) (Cleats and Knobs.)

POROUS CUPS. See Cups.

POROUS JARS.
Colonial Sign & Insulator Co., Akron, Ohio.

PORTABLE FANS. See Fans.

PORTABLE GUARDS. See Guards.

PORTABLES. Electric Reading Lamps, Portables, Floor Portables.
Beers Sales Co., Bridgeport, Conn.
Faries Mfg. Co., Decatur, Ill.
Franks Mfg. Co., Rock Island, Ill.
H. W. Johns-Manville Co., New York.
Phoenix Glass Co., New York.
St. Louis Brass Mfg. Co., St. Louis, Mo.
Vote-Berger Co., La Crosse, Wis. "Badger".
Western Lamp & Brass Works, Chicago, Ill.
Acme Metal Mfg. Co., Chicago, Ill.
Amboy Works, New York, N. Y.
Art Brass & Fixture Mfg. Co., McKees Rocks, Pa.
Bradley & Hubbard Mfg. Co., Meriden, Conn.
Chicago Lamp & Fixture Co., Chicago, Ill.
Cincinnati Artistic Wrought Iron Works, Cincinnati, Ohio.
Colonial Art Glass Co., Chicago.
Dale Co., The, New York, N. Y.
Enterprise Lamp Mfg. Co., New York, N. Y.
Excelsior Brass Works, Reading, Pa.
Flanagan & Biedenweg Co., Chicago, Ill.
Fulper Pottery Co., Flemington, N. J.
Gail-Webb Mfg. Co., Buffalo, N. Y.
Gold Furniture Co., Chicago, Ill.
Goodwin & Kintz Co., Winsted, Conn.
Goshen Stamping & Brass Co., Goshen, Ind. "Security".
Gudeman & Co., New York, N. Y. (Decorative.)
Handel Co., Meriden, Conn.
Harley Mach. Co., Springfield, Mass.
Herwig Art Lamp Shade Co., Chicago, Ill.
Andrew H. Hoag Co., New York.
Imperial Art Glass & Lamp Works, New York, N. Y.
Lynch Co., Geo. C., New York.
McFaddin Co., H. G., New York, N. Y. "Emeralite".
McKenney & Waterbury Co., Boston, Mass. "Harrigan".
McLeod, Ward & Co., New York, N. Y. "Kinsman".
Manhattan Art Glass & Metal Co., New York, N. Y.
Edward Miller & Co., Meriden, Conn.
Morgan & Sons, John, New York.
Morse, Frank W., Boston, Mass. "Electrofier".
Neuhauser Co., D. L., Chicago, Ill.
Noe & Sons, Wm. R., New York.
Pacific Electric Co., La Crosse, Wis. "Esperson".
Paragon-Sellers Co., Chicago.
Patterson Tool & Supply Co., Dayton, Ohio.
Pefco Sales Co., Peoria, Ill.
Pittsburgh Lamp Brass & Glass Co., Pittsburgh, Pa.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rostetter & Son, Fort Wayne, Ind.
Salo Mfg. Co., Binghamton, N. Y.
Schuler Art Glass Co., Chicago.
A. J. Scribner, Gloversville, N. Y.
Stavenhagen Co., W. H., Town of Union, N. J.
Steblin-Miller & Hones Co., New York, N. Y. "Rockoff".
Tietgen, Falk & Co., Chicago, Ill.
Turner & Seymour Mfg. Co., Torrington, Conn.
Unique Art Glass & Metal Co., Brooklyn, N. Y.
Wappler Electric Mfg. Co., New York.
Weintraub Brass Mfg. Co., New York, N. Y.
Wells Light Co., Jersey City, N. J. "Wallworks".
Whaley & Co., J. A., New York.
O. C. White Co., Worcester, Mass.
L. A. Williamson Co., New York. "Flexilyte."

POSTS, Lamp Arc, Tungsten.
Central Electric Co., Chicago, Ill.
Cutter Co., Geo., South Bend, Ind.
Flour City Ornamental Iron Works, Minneapolis, Minn.
King Foundry Co., St. Joseph, Mo.
Line Material Co., South Milwaukee, Wis. "Mitre." "Ionic."
McDonnell Boiler & Iron Works, Des Moines, Iowa.
Fred J. Meyers Mfg. Co., Hamilton, Ohio.
Line Material Co., South Milwaukee, Wis. "Mitre." "Ionic."
J. G. Birtness Sons Co., Davenport, Iowa. (Moulds for making concrete posts.)
Cheesman & Co., M. V., Mishawaka, Ind.
Cross Bros. Iron Wks., Eugene, Ore.
Davenport Machine & Foundry Co., Davenport, Iowa.
Dearborn Foundry Co., Chicago.
Delta-Star Electric Co., Chicago.
Des Moines Electric Contracting Co., Des Moines, Ia.
Electric Railway Equipment Co., Cincinnati, Ohio.
Fiske Iron Works, J. W., New York, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kramer Bros. Foundry Co., Dayton, Ohio.
Love Bros., Aurora, Ill.
Lundin Elec. & Mach. Co., Boston, Mass.
Minneapolis Steel & Machinery Co., Minneapolis, Minn. "Muenzel".
J. L. Mott Iron Works, New York.
Ornamental Lighting Pole Co., New York.
Paxton & Vierling Iron Co., Omaha, Neb.
Pettyjohn Co., Terre Haute, Ind. (Reinforced Granite Concrete.)
Philadelphia Elec. & Mfg. Co., Philadelphia, Pa.
Smyser-Royer Co., Philadelphia.
St. Louis Car Wheel Co., St. Louis, Mo.
St. Paul Foundry Co., St. Paul.
Union Metal Mfg. Co., Canton, Ohio.
Wallace Machine & Foundry Co., Lafayette, Ind.
Western Gas Cons. Co., Fort Wayne, Ind. "Ionic".

POSTS, Binding. See Binding Posts.

POTENTIOMETERS.
Leeds & Northrup Co., Philadelphia, Pa.
Queen-Gray Co., Philadelphia, Pa.

POTHEADS AND SLEEVES, Pothead Brackets.
F. Bissell Co., Toledo, Ohio.
Brady Electric Mfg. Co., New Britain, Conn.
Central Electric Co., Chicago, Ill.
Electrical Engineers Equipment Co., Chicago, Ill.
Fairmount Elec. & Mfg. Co., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hickey & Schneider, New York, N. Y.
Mineralac Electric Co., Chicago.
Okonite Co., New York, "Candee".
Standard Underground Cable Co., Pittsburgh, Pa.
Colonial Sign & Insulator Co., Akron, Ohio. (All Porcelain Potheads.)
Delta-Star Electric Co., Chicago.
G. & W. Elec. Specialty Co., Chicago, Ill. (Porcelain.)
Moon Mfg. Co., Chicago, Ill. (Self-Soldering.)

POWER FACTOR METERS. See Instruments.

PRESERVATIVES, Wood.
Carbolineum Wood Preserving Co., Milwaukee, Wis.
General Bakelite Co., New York.
Lindsley Bros. Co., Spokane, Wash.
American Mfg. Co., Minneapolis, Minn. "Creoseptine".
American Wood Preserving Co., Chicago, Ill. "Antiseptine".
Anthracenol Wood Preserving Co New York. "Barol".
Atlas Preservative Co. of America, New York.
L. S. Brach Supply Co., New York.
Cabot, Samuel, Boston, Mass. "Conservo".
Di-Electric Mfg. Co., St. Louis, Mo. "Phenoleum".
Grosche & Co., Bruno, New York. "S. B. F. Carbolineum".
Indiana Refining Co., Cincinnati, Ohio. "Timbershalt".
Missouri Black Enamel & Paint Co., St. Louis, Mo. "Keystone".
Patton Paint Co., Milwaukee, Wis.
U. S. Wood Preserving Co., New York.
Universal Pole & Post Preserving Co., Circleville, Ohio.
Western Lumber & Pole Co., Denver, Colo.
C. A. Wood Preserver Co., St. Louis, Mo.

PRESSES, Coil. See Coil Forming Devices.

PRESSES, Power. For Punching Out Discs and Segments.
Bliss Co., E. W., Brooklyn, N. Y.
Cleveland Punch & Shear Works, Cleveland, Ohio.

Ferracute Mach. Co., **Bridgeton, N. J.**
Hilles & Jones Co., Wilmington, Del.
Long & Allstatter Co., Hamilton, Ohio.

PRESSURE GAUGES. (Electric Alarm.)
Bristol Company, Waterbury, Conn.
A. C. Scribner, Gloversville, N. Y.

PRINTERS' AND BOOKBINDERS' MACHINERY. (Motor Driven.)
American Folding Machine Co., Cleveland, Ohio.
Amer. Type Founders Co., Boston, Mass. (Stitching Machines.)
Automatic Coinwrapping Machine Co., New York. (Mailing Machines.)
Barnhart Bros. & Spindler Co., New York. (Saw Trimmers.)
Buffum Tool Co., Louisiana, Mo. (Automatic Printing Presses.)
Chambers Brass Co., Philadelphia, Pa. (Paper Folding Machines.)
Dexter Folding Co., Pearl River, N. Y. (Folding Machinery.)
Hickok Mfg. Co., W. O., Harrisburg, Pa. (Book Binders' Machinery.)
Latham Machinery Co., Chicago, Ill. (Stitchers.)
Mergenthaler Linotype Co., New York. (Typesetting and Casting Machines.)
Miehle Printing Press & Mfg. Co., Chicago, Ill. (Printing Presses.)
Murray Machinery Co., Kansas City, Mo. (Photoengraving, Electrotype and Color Press Machinery.)
Pan-Electric Mfg. Co., St. Louis, Mo. (Job Press Outfits.)
Rosback Co., F. P., Benton Harbor, Mich. (Perforators and Stitchers.)
Roth Tool Co., B., St. Louis, Mo. (Embossing Presses.)
Royle & Sons, John, Paterson, N. J. (Routing Machines.)
Unitype Co., Brooklyn, N. Y. (Typesetting Machines.)
Wagenhorst & Co., J. H., Youngstown, Ohio.
Wesel Mfg. Co., F., New York. (Trimming and Shaving Machines.)

PRINTING ATTACHMENTS FOR METERS.
Mineralac Electric Co., Chicago.

PRISMS.
See Crystals.

PRODUCERS, Gas.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Westinghouse Machine Co., East Pittsburgh, Pa.
Amsler Engrg. Co., Pittsburgh, Pa.
DuBois Iron Works, DuBois, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Fulper Pottery Co., Flemington, N. J.
Gas Machinery Co., Cleveland, Ohio.
Gates Potteries, Terra Cotta, Ill.
Industrial Power Co., Milwaukee, Wis. "Atkinson".
Minnesota Elec. Co., Minneapolis, Minn.
Minneapolis Steel & Mch. Co., Minneapolis, Minn.
New York Engine Co., New York, N. Y.
Power & Mining Machinery Co., New York, N. Y. "Loomis-Pettibone".
Sheffield Gas Power Co., Kansas City, Mo.
Western Gas Engine Co., Los Angeles, Calif.
Wile Power Gas Co., Rochester, N. Y.
Wood & Co., R. D., Philadelphia.

PROJECTORS, Electric. (Search Lights.) For Stage Projectors. See Stage.
Fort Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Benton Electric Co., La Crosse, Wis.
Bogue Electric Co., C. J., New York, N. Y.
Carlisle & Finch Co., Cincinnati, Ohio.
Condit Elecl. Mfg. Co., Boston, Mass.
Globe Elec. & Mfg. Co., New York, N. Y.
Jos. Menchen Elec. Co., New York.
Rushmore Dynamo Works, Plainfield, N. J.
Silvey Electric Co., Dayton, O.

PROJECTORS, Post Card.
Victor Animatograph Co., Inc., Davenport, Ia.

PROJECTORS, Sign.
Electro Ad-Lite Co., New York.
Pittsburg Electric Specialties Co., Pittsburg, Pa.

PROJECTORS, Telephone. (See also Fuses, Telephone.)
D & W Fuse Co., Providence, R. I.
Frank B. Cook, Chicago.
Homer Roberts Mfg. Co., Chicago, Ill.

PULL CHAIN INSULATORS.
See Insulators.

PULL SOCKETS. See Sockets.

PULLEYS, Arc Lamp. (See also Pulleys, Cutout.)
George Cutter Co., South Bend, Ind.
Fort Wayne Elec. Works, Fort Wayne, Ind.
Line Material Co., South Milwaukee, Wis.
Fletcher Mfg. Co., Dayton, Ohio.
Electrical Construction Supply Co., Springfield, Ohio.
Philadelphia Elec. & Mfg. Co., Philadelphia, Pa.

PULLEYS, Cutout. (For Arc Lamps.)
Geo. Cutter Co., South Bend, Ind.
Line Material Co., South Milwaukee, Wis.
National Sewing Machine Co., Belvidere, Ill. "Mayo", "Belvidere."
Thompson Electric Co., Cleveland, O.

PULLEYS, Paper.
Rockwood Mfg. Co., Indianapolis.

PULLEYS, Wood.
Bradford Belting Co., Cincinnati, Ohio. "Monarch".
Detroit Wood Pulley Co., Detroit, Mich.
Dodge Mfg. Co., Mishawaka, Ind. "Independence".
Donegan & Swift, New York, N. Y. "Swifts".
Keasey Pulley Co., Toledo, Ohio.
Medart Patent Pulley Co., St. Louis, Mo.
Ohio Pulley Co., Marion, Ohio. "Buckeye".
Ohio Valley Pulley Works, Maysville, Ky. "Limestone".
Oneida Steel Pulley Co., Oneida, N. Y.
Paul Mfg. Co., Fort Wayne, Ind.
Reading Wood Pulley Co., Reading, Pa.
Reeves Pulley Co., Columbus, Ind.
Saginaw Mfg. Co., Saginaw, Mich. "Gilbert".
South Bend Pulley Co., South Bend, Ind.
Wing & Co., J. T., Detroit, Mich. "Detroit".

PULLS, Socket. See Attachments.

PULMOTORS.
Draeger Oxygen Apparatus Co., Pittsburgh, Pa.

PUMPS, Air and Vacuum. (See also Brushes, Pneumatic), and Garage Pumps.
Bishop - Babcock - Becker Co., Cleveland, Ohio. ("Eureka" Air Pumps.)
Brunner Mfg. Co, Utica, N. Y.
A. M. Carron, Pittsburgh, Pa.
Connersville Blower Co., Connersville, Ind. (Vacuum.)
Connellsville Machine & Car Co., Connellsville, Pa. (Vacuum.)
Dal Mfg. Co., Chicago, Ill. (Tire Pumps.)
Gearless Automatic Pump Co., Rock Island, Ill.
Kellogg Mfg. Co., Rochester, N. Y. (Auto Tire.)
Leiman Bros., New York. (Vacuum.)
Palm Engineering Co., Detroit, Mich. (Vacuum.)
Pittsburgh Automatic Air Pump Co., Pittsburgh, Pa.
Siebert-Welch Co., Columbus, O.

PUMPS, Beer.
Brown Beer Pump Co., E. E., **Boston, Mass.**
Iowa Mfg. Co., Oskaloosa, Iowa.
Varwig Mfg. Co., Cincinnati, Ohio.

PUMPS, Water.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Wis. (High Duty Pumping Engines.)
Advance Pump & Compressor Co., Battle Creek, Mich.
Alberger Condenser & New York. (Centrifugal.)
Allentown Rolling Mills, Allentown, Pa. "Aldrich" (Sinking Pumps).
American Steam Pump Co., Battle Creek, Mich. "Marsh".
American Well Works, Aurora, Ill.
Automatic Rotary Pump Co., New York, N. Y.
Barnes Mfg. Co., Mansfield, Ohio. (Power Only.)
Beach-Russ Co., Brooklyn, N. Y. (Rotary.)
Blackmer Rotary Pump Power Mfg. Co., Petoskey, Mich. (Water Pumps.)
Blake Pump & Condenser Co., Fitchburg, Mass.
Blakeslee Mfg. Co., Duquoin, Ill.
Bliss Co., E. W., Brooklyn, N. Y. "Marbourg".
Buffalo Steam Pump Co., Buffalo.
A. S. Cameron Steam Pump Works, N. Y.
Canton-Hughes Pump Co., Canton, Ohio.
Centrifugal Pump Co., New York, N. Y. (Silent Elec. Centrifugal House Pump.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Works, Columbus, Ohio.
Davidson, M. T., New York.
Dayton Hydraulic Machinery Co., Dayton, Ohio. (Turbine.)
Dean Bros. Steam Pump Co., Indianapolis, Ind.
De Laval Steam Turbine Co., Trenton, N. J. (Centrifugal.)
Deming Co., Salem, Ohio.
Douglas, W. & B., Middletown, Conn.
Dow Pumping Engine Co., Geo. E., San Francisco, Calif.
DuBois Iron Works, DuBois, Pa.
Epping-Carpenter Co., Pittsburgh, Pa.
Erie Pump & Engine Works, Erie, Pa. (Turbine.)
Erwin & Co., Chicago, Ill. (Triplex.)
Evans & Co., C. H., San Francisco, California. "Thompson & Evans".
Fairbanks, Morse & Co., Chicago.
Fort Wayne Engrg. & Mfg. Co., Fort Wayne, Ind. ("Paul" House Pump.)
Foster Pump Works, Brooklyn, N. Y. "Hardick".
Franklin Iron Works, Pottsville, Pa.
Gardner-Governor Co., Quincy, Ill.
Globe Mfg. Co., Battle Creek, Mich.
Goulds Mfg. Co., Seneca Falls, N. Y. (Power.)
Goyne Steam Pump Co., Ashland, Pa.
Grant Iron Works, Mahanoy City, Pa.
Guild & Garrison, Brooklyn.
Hall Steam Pump Co., Allegheny, Pa.
Harris Pump & Supply Co., Pittsburgh, Pa.
Heisler Co., St. Marys, Ohio.
Hill Machine Co., Anderson, Ind (House Pumps.)
Holland Machine Co., New York.
Hooker Steam Pump Co., St. Louis, Mo.
International Steam Pump Co., New York, N. Y. "Deane", "Blake", "Jeansville", "Shaw", "Knowles", "Laidlaw-Dunn-Gordon", "Prescott", "Worthington".
Jackson Byron Iron Works, Berkeley, Cal. (Sinking Pumps.)
Janette Mfg. Co., Chicago, Ill.
Jarvis Engine & Machine Works, Lansing, Mich. "House Pumps".
Jeffrey Mfg. Co., Columbus, Ohio. (Mine Only.)
Benj. F. Kelley & Son, New York.
Kerr Turbine Co., Wellsville, N. York. (Turbo Pumps.)
Lea Equipment Co., New York. (Turbine.)
Lucas Pump Co., Dayton, Ohio. ("Best-yet" Power Pump.)
Luitwieler Pumping Engine Co., Rochester, N. Y.
Manistee Iron Works Co., Manistee, Mich.
Mason Regulator Co., Boston.
Mast, Foos & Co., Springfield, Ohio. ("Buckeye" Power only.)
John H. McGowan Co., Cincinnati, Ohio.
Samuel L. Moore & Sons, Elizabeth, N. J.
Morris Machine Works, Baldwinsville, N. Y.
Mutual Beer Pump Co., New York.
F. E. Myers & Bro., Ashland, Ohio.
National Steam Pump Co., Upper Sandusky, Ohio.
Frank L. Patterson & Co., New York.
Pattin Bros. Co., Marietta, Ohio.
Platt Iron Works Co., Dayton, Ohio. "Smith-Vaile".
Reliance Machine & Tool Works, St. Louis, Mo. "Hooker".
Rider-Ericsson Engine Co., New York. ("Reco" House Pump.)
Geo. J. Roberts Co., Dayton, Ohio.
P. H. & F. M. Roots Co., Connersville, Ind.
Rotary House Pump Co., New York. "Von Pittler".
Roth Mfg. Co., Columbus, Ind.
Rumsey & Co., Ltd., Seneca Falls, N. Y. (Power only.)
Sanitary Pump Co., Dayton, O.
Schaefer Bros. Co., Chicago, Ill.
Scranton Steam Pump Co., Scranton, Pa.
Service Pump Co., Orrville, Ohio. "Conkell".
Star Pump Co., Boston, Mass.
Stewart Heater Co., Buffalo.
Taber Pump Co., Buffalo, N. Y. (Rotary.)
Thomas & Smith, Chicago, Ill. ("Economy" House Pump.)
Twinvolute Pump & Mfg. Co., New York, N. Y.
Union Steam Pump Co., Battle Creek, Mich. "Burnham", "Moore".
United Pump & Power Co., Chicago, Ill. (Water Pump.)
Valle-Kimes Co., Dayton, O.
Victor Electric Co., Chicago, Ill.
Walker Mfg. Co., Fenton, Mich.
Warren Steam Pump Co., Warren, Mass.
Weinman Pump Mfg. Co., Columbus, Ohio. (House Service.)
C. H. Wheeler Mfg. Co., Philadelphia, Pa.
Wickes Bros., Saginaw, Mich.
Wilkinson Foundry & Mfg. Co., Bridgeport, Pa.
Wilson-Snyder Mfg. Co., Pittsburgh, Pa.
R. D. Wood & Co., Philadelphia, Pa. (Centrifugal.)
Yeomans Bros., Chicago, Ill.
E. R. Young & Sons, Titusville, Pa. "Locke".

PUMPING SYSTEMS, Electro-Pneumatic.
Sanitary Pump Co., Dayton, Ohio.

PUSH BUTTONS.
Central Electric Co., Chicago, Ill.
Chicago Glass Novelty Co., Marion, Ind.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Pass & Seymour, Inc., Solvay, N. Y. "No Scru".
Manhattan Electrical Supply Co., New York. "Reliable" (Floor Thread).
W. R. Ostrander & Co., New York.
U. S. E. M. Co., New York. (Non-grounding.)
Western Electric Co., New York, N. Y.
Altman & Co., Chicago, Ill. (Portable Desk.)
American Car & Ship Hardware Co., New Castle, Pa.
Ansonia Electrical Co., Ansonia, Conn.
Albert Bohm, New York. (Imported.)
Bunnell & Co., J. H., New York, N. Y.
Cleverly Electric Works, Philadelphia, Pa.
P. & F. Corbin, New Britain, Conn.
S. H. Couch Co., Boston, Mass. "Pushrite", "Workrite".
De Veau Tele. Mfg. Co., Brooklyn, N. Y. "Auth."
Edwards & Co., New York. "New Mite," "Midget, Jr."
Electric Goods Mfg. Co., Canton, Mass.
Holtzer-Cabot Electric Co., Brookline, Mass.
Francis Kell & Son, New York. "Anti-Wood," "Anti-Screw Midget."
Long Island Electrical & Machine Works, Richmond Hill, N. Y.
Wm. J. Murdock Co., Chelsea, Mass.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Reading Hardware Co., Reading, Pa.
Russell & Erwin Mfg. Co., New Britain, Conn.
Sargent & Co., New York.
I. S. Spencer's Sons, Guilford, Conn.
Union Hardware Co., Torrington, Conn.

A. H. Warner & Co., Bristol, Conn.
Wilhelm, H., Brooklyn, N. Y.

PYROMETERS, Electric.
Bristol Co., Waterbury, Conn.
Leeds & Northrup Co., Philadelphia, Pa.
American Steam Gauge & Valve Co., Boston, Mass.
Ashcroft Mfg. Co., New York.
Brown Instrument Co., Philadelphia, Pa.
E. Du Vivier, New York. (Importers. "Richard" Recording.)
Esterline Co., Lafayette, Ind.
Hoskins Mfg. Co., Detroit, Mich.
Industrial Instrument Co., Foxboro, Mass.
Keystone Electrical Instrument Co., Philadelphia, Pa.
Morse Thermo-Gage Co., Ithaca, N. Y.
Price Electric Co., Cleveland, Ohio.
Queen-Gray Co., Philadelphia, Pa.
Taylor Instrument Company, Rochester, N. Y. "Tycos".
Thompson-Levering Co., Philadelphia, Pa. "Peerless".
Thwing Instrument Co., Philadelphia, Pa.
Wilson-Maulen Co., New York. ("Fery" Electric, "Advance".)

RACKS AND RINGS, Telephone Distributing.
F. Bissell Co., Toledo, Ohio.
Hubbard & Co., Pittsburg, Pa.
Frank B. Cook, Chicago.
T. J. Cope, Philadelphia, Pa.
Hallett Iron Works, Chicago, Ill.
Kinsey Mfg. Co., Toledo, Ohio.
North Penn Iron Co., Philadelphia, Pa.
Charles Nuhring & Bro., Cincinnati, Ohio. "Underwriters." "Safety."
Star Expansion Bolt Co., New York.

RACKS, Cable. (See Cable Racks.)

RADIATORS, Luminous.
General Electric Co., Schenectady.
American Electrical Heater Co., Detroit, Mich.
Mathbone & Panigot Co., Grand Rapids, Mich.
Simplex Engineering Co., Philadelphia, Pa. "Quartzalite."

RAIL BONDS.
American Steel & Wire Co., Chicago.
General Electric Co., Schenectady.
H. W. Johns-Manville Co., New York, N. Y.
Rail Joint Co., New York, N. Y.
John A. Roebling's Sons Co., Trenton, N. J.
Western Electric Co., New York.

RAIL JOINTS.
American Steel & Wire Co., Chicago.
Rail Joint Co., New York, N. Y.
Western Electric Co., New York.
Ohio Brass Co., Mansfield, O.

REAMERS, Pipe. (See Pipe Fitting Tools.)

RECEPTACLES, Floor. (See Boxes, also Stage Plugs and Receptacles.)

RECEPTACLES, Sign.
Arrow Electric Co., Hartford, Conn. "Arrow E."
Benjamin Electric Mfg. Co., Chicago, Ill.
Federal Sign System (Electric), Chicago.
General Electric Co., Schenectady, N. Y.
H. T. Paiste Co., Philadelphia, Pa. "Fielding."
Pass & Seymour, Inc., Solvay, N. Y.
Stanley & Patterson, New York. "New Code".
Union Electric Co., Trenton, N. J.
Atlantic Electric Goods Co., New York. "Stewart".
Betts & Betts, New York. "Dyke".
Bryant Electric Co., Bridgeport, Conn.
Crouse-Hinds Co., Syracuse, N. Y. "Conduiette", "Norbitt".
E. H. Freeman Electric Co., Trenton, N. J. "Russell".
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Peru Elec. Co., Peru, Ind.
Tregoning Electric Mfg. Co., Cleveland, Ohio.

RECEPTACLES, Standard. See Sockets and Receptacles.

RECEPTACLES, Waterproof, Lamp-Enclosing. See Marine Fixtures.

RECEPTACLES, Weatherproof.
Arrow Electric Co., Hartford, Conn. "Arrow E."
Electric Appliance Co., Chicago, Ill. "Easo Watight."
Federal Sign System (Electric), Chicago, Ill.
General Electric Co., Schenectady, N. Y.
H. T. Paiste Co., Philadelphia.
Pass & Seymour, Inc., Solvay, N. Y.
Stanley & Patterson, New York.
Atlantic Electric Goods Co., New York.
Bryant Electric Co., Bridgeport, Conn.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crouse-Hinds Co., Syracuse, N. Y. ("Norbitt" Weatherproof.)
Empire Elec. Mfg. Co., Plainville, Conn.
E. H. Freeman Electric Co., Trenton, N. J.
Harter Mfg. Co., Chicago.

RECORDERS, Combustion.
Precision Instrument Co., Detroit, Mich. "Simmance-Abady".
Sarco Fuel Savings & Engineering Co., New York.
Uehling Inst. Co., Passaic, N. J.

RECORDERS, Time.
Bristol Company Waterbury, Conn.
Calculagraph Co., New York.

RECTIFIERS, Current. (For charging storage batteries).
General Electric Co., Schenectady, N. Y.
Wagner Elec. Mfg. Co., St. Louis, Mo. (Rotary, Vibrating).
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. ("Cooper Hewitt" Mercury Arc), (Electrolytic).
American Battery Co., Chicago, Ill. (Electrolytic.)
J. F. Ashbrook, Chicago, Ill. "Johns".
Churcher Electric & Mfg Co., Cincinnati, Ohio.
Como Electric Co., Spring Lake, N. J. "Hickley".
C. E. Cook Electric Co., Los Angeles, Calif.
Electric Economy Co., Roxbury, Boston, Mass.
Lincoln Electric Co., Cleveland.
Mohawk Electric Co., Albany, N. Y. (Electrolytic.)
Wm. Meyer Co., Chicago, Ill.
Murphy Electricity Rectifier Co., Rochester, N. Y.
Sirch Elec. Testing Laboratories, Los Angeles, Calif.
Victor Electric Co., Chicago, Ill.

REEL STANDS.
Device Improvement Co., Hanover, Pa.

REELS, Wire, Pay Out, Take Out.
Mathias Klein & Sons, Chicago.
Minneapolis Elec. & Const. Co., Minneapolis, Minn.
Oshkosh Mfg. Co., Oshkosh, Wis.
Anderson Tool & Supply Co., Detroit, Mich.
T. J. Cope, Philadelphia, Pa.
Dicke Tool Co., Downers Grove, Ill.
W. F. Irish Electric Co., New York.
The Kinsey Mfg. Co., Toledo, O.
Fred L. Meckel, Chicago, Ill.
U. S. Bobbin & Shuttle Co., Providence, R. I.
John J. Waldman, New York.
Wasson Reel Co., Clinton, Ill.

REELS AND SPOOLS, Empty.
American Pulley Co., Philadelphia, Pa.
Frank Mossberg Co., Attleboro, Mass. (Metal.)

REFLECTORS, Glass. See Glassware.

REFLECTORS, Metal. See Shades, also Fixtures, Show Case.

REFLECTORS, Mirror.
Helophane Works of General Electric Co., Cleveland, O.
H. W. Johns-Manville Co., New York.
Reynolds Electric Flasher Mfg. Co., Chicago. (For lighting billboards.)
American Reflector & Ltg. Co., Chicago, Ill. "Paragon".
Bailey Reflector Co., Pittsburgh.
Chicago Lamp & Fixture Co., Chicago, Ill. "Block's Brilliant".
Consolidated Sheet Metal Works, Milwaukee, Wis.
Klemm & Co., Philadelphia, Pa.
National X-Ray Reflector Co., Chicago, Ill. "I-Comfort," "X-Ray," "Scoop," "Helmet," "Poke Bonnet."
Overbagh & Ayres Mfg. Co., Chicago, Ill. "Oamco".
Partridge, W. W., Chicago, Ill.
Sidley Co., Thos. H., Chicago.
Sunlight Reflector Co., Brooklyn.
Tea Tray Co., Newark, N. J.
Weeks, Nelson, New York, N. Y.
Western Reflector Co., Chicago.

REFRIGERATORS AND ICE MACHINES (Electric).
H. W. Johns-Manville Co., New York.
Triumph Ice Machine Co., Cincinnati, Ohio.
Automatic Refrigerating Co., Hartford, Conn.
Baker Ice Machine Co., Omaha.
Brecht Co., St. Louis, Mo.
Brunswick Refrigerating Co., New Brunswick, N. J.
Carbondale Machine Co., Carbondale, Pa. (Exhaust Steam Ice Machine.)
Cleveland Ice Machine Co., Cleveland, Ohio.
De La Vergne Machine Co., New York.
Ruemmell-Dawley Mfg. Co., St. Louis, Mo.
Wegner Machine Co., Buffalo.
Fred W. Wolf Co., Chicago, Ill.
York Mfg. Co., York, Pa.

REGISTERS, Telephone. See Meters.

REGULATORS, Feed Water.
Roche Engineering Co., Philadelphia.
Northern Equipment Co., Chicago.

REGULATORS, Temperature.
Stanley & Patterson, New York.
Johnson Electric Service Co., Milwaukee, Wis.
Powers Regulator Co., Chicago.
C. J. Tagliabue Co., New York.

REGULATORS, Voltage.
Electric Controller & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady, N. Y.
Condit Elect. Mfg. Co., Boston, Mass. (Alt. Current.)
Gilmore Electric Co., Boston, Mass. "Chapman".
Hartman Electrical Mfg. Co., Mansfield, Ohio.
Lincoln Electric Co., Cleveland.
Portland Co., Portland, Me. "W. M. C."

REPAIRS, Armature.
Commonwealth Edison Co., Chicago, Ill.
Waterbury Co., Waterbury, Conn.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

REPLACERS, Inc. Lamp. See Lamp Changers or Replacers.

RESISTANCE COILS. See Coils.

RESISTANCE, Banks and Units.
Allen-Bradley Co., Milwaukee, Wis.
Badt-Westburg Electric Co., Inc., Chicago.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Dixon Crucible Co., Joseph, Jersey City, N. J.
General Electric Co., Schenectady, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Sprague Electric Works, New York.
Sundh Electric Co., New York.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wirt Co., Germantown, Pa. "Dielite."
Hoskins Mfg. Co., Detroit, Mich.
Ward Leonard Electric Co., Bronxville, N. Y.

RESISTANCE WIRE & RIBBON.
Belden Mfg. Co., Chicago, Ill.
Driver-Harris Wire Co., Harrison, N. J.
"Climax," "S. R.," "Advance," "Nichrome", "Hercules".
Moore, Alfred F., Philadelphia.
Wirt Co., Germantown, Pa. "Dielite."
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Boker & Co., Herman, New York. (Importers "Excello," "Superior," "A. 1, A. 1.")
Bradford, Kyle & Co., Plymouth, Mass.
Coe Brass Mfg. Co., Torrington, Conn.
Electrical Alloy Co., Morristown, N. J. "Ideal," "Calido." "Prenix," "Grade A."
Hoskins Mfg. Co., Detroit, Mich.
Hudson Wire Co., New York.
Murray Wire Co., Newark, N. J.
Nash Co., Geo., New York. "Acme."
Prosser & Son, Thomas, New York. "Krupp".
Trenton Iron Co., Trenton, N. J. "Tico".
Washburn Wire Co., Phillipsdale, R. I.
Waterbury Brass Co., Waterbury, Conn.

REVERSING CONTROLLERS FOR CRANES, ETC.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REVOLUTION COUNTERS. See Counters, Revolution.

RHEOSTATS.
Allen-Bradley Co., Milwaukee, Wis.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Badt-Westburg Electric Co., Inc., Chicago.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, Ohio.
Fort Wayne Electric Works, Fort Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Sundh Electric Co., New York.
Sprague Electric Works, New York.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Fairbanks-Morse Electrical Mfg. Co., Indianapolis, Ind.
Lord Mfg. Co., New York, N. Y.
E. Marcuson, New York. "Withan."
Monitor Controller Co., Baltimore, Md.
National Electric Controller Co., Chicago.
Union Electric Mfg. Co., Milwaukee, Wis.
Ward Leonard Electric Co., Bronxville, N. Y.

RHEOSTATS, Battery Charging.
Allen-Bradley Co., Milwaukee, Wis.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Badt-Westburg Electric Co., Inc., Chicago.
General Electric Co., Schenectady, N. Y.
Independent Electric Mfg. Co., Milwaukee, Wis.
Simplex Electric Heating Co., Cambridge, Mass. "Universal".
Universal Electric Stage Lighting Co., New York. "Kliegl."
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Wirt Co., Philadelphia, Pa.
Arendt Electric Controller Co., Oakland, Calif.
Bell & Howell Co., Chicago, Ill. (Inductor Compensator.)
Churcher Electric & Mfg. Co., Cincinnati, Ohio. (Battery Charging.)
Enterprise Optical Mfg. Co., Chicago. ("Rheostat for Moving Pictures.")
Fairbanks-Morse Electrical Mfg. Co., Indianapolis, Ind.
J. H. Hallberg, New York. (Economizer for Moving Picture Lamps.)
Leonard Bundy Electric Co., Cleveland, Ohio. (Battery Charging.)
Marcuson, E., New York. "Withan."
J. Menchen Elec. Co., New York.
Union Electric Mfg. Co., Milwaukee, Wis.
Ward Leonard Electric Co., Bronxville, N. Y.

RHEOSTATS, Cautery. See Medical Apparatus.

RHEOSTATS, Motor Controlling. (Starting and Speed Regulating.)
Allen-Bradley Co., Milwaukee, Wis.
Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Badt-Westburg Electric Co., Inc., Chicago.
Cutler-Hammer Mfg. Co., Milwaukee, Wis. "Schureman."
Electric Controller & Mfg. Co., Cleveland, Ohio. "Dinkey".
Fort Wayne Electric Works, Fort Wayne, Ind. "Compensaro."
General Electric Co., Schenectady, N. Y.

Independent Elec'l Mfg. Co., Milwaukee, Wis.
Simplex Electric Heating Co., Cambridge, Mass. "Universal".
Triumph Electric Co., Cincinnati, Ohio.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Automatic Switch Co., New York. "Whittingham".
Barkelew Electric Mfg. Co., Middletown, Ohio.
R. W. Brown, Amsterdam, N. Y.
Esterline Co., Lafayette, Ind.
Federal Elec. Co., North Girard, Pa.
O. H. Gensler, Webster, Pa.
Lincoln Electric Co., Cleveland, Ohio.
Monitor Mfg. Co., Baltimore.
New York Elec. Controller Co., New York.
Reno-Kaetker Electric Co., Cincinnati, Ohio. "Reliance".
Schaefer Bros. Co., Chicago, Ill.
Traction Equipment Co., Brooklyn, N. Y.
Union Electric Mfg. Co., Milwaukee, Wis.
United Pump & Power Co., Chicago, Ill. ("Perry" Motor Controller.)
Ward Leonard Electric Co., Bronxville, N. Y.
Woolf Motor Protecting Switch Co., San Francisco, Calif.

RHEOSTATS, Stage Dimming.
Allen-Bradley Co., Milwaukee, Wis.
Badt-Westburg Electric Co., Inc., Chicago.
Campbell Electric Co., Lynn, Mass.
Cutler-Hammer Mfg. Co., Milwaukee, Wis. "Simplicity".
General Electric Co., Schenectady, N. Y.

RINGERS, Bell. See Transformers, Low Voltage. (See Bell Ringing Motors.)

RINGERS, Extension. (See Magnetos, Magneto Generators and Bells.)

RINGS, Distributing. (See Racks and Rings.)

RINGS AND HOOKS. (Insulating Bridle Rings, Insulating Hooks.)
Hubbard & Co., Pittsburgh, Pa.
M. S. Brooks & Sons, Chester, Conn.
Cameron Appliance Co., Everett, Mass.
Diamond Expansion Bolt Co., New York. ("D-X" Bridle Rings.)
H. L. Judd Co., New York. (Bridle Rings.)
Pettingell-Andrews Co., Boston, Mass.
Star Expansion Bolt Co., New York.

RINGS, Pole.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
F. Bissell Co., Toledo, Ohio.
Hubbard & Co., Pittsburgh, Pa.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Creaghead Engrg. Co., Cincinnati, Ohio.
M. Lanz & Sons, Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Strieby & Foote Co., Newark, N. J.

RODS, Conduit. (See Conduit Rods.)

ROLLERS, Cable Pulling.
F. Bissell Co., Toledo, Ohio.
Mathias Klein & Sons, Chicago, Ill. "Matlock".
W. N. Matthews & Bro., St. Louis, Mo.
T. J. Cope, Philadelphia, Pa.
Hallet Iron Works, Chicago, Ill.
Specialty Device Co., Cincinnati, Ohio. "Bierce".

ROPE COUPLINGS. (For transmission ropes.)
C. W. Hunt Co., West New Brighton, N. Y.

ROSETTES. (See Cut-outs.)

RUBBER, Molded. See Insulation.

RUBBER GLOVES. See Gloves.

RUBBER PROTECTIVE DEVICES. See also Gloves.
Linemen Protector Co., Detroit, Mich.

RUBBER SPECIALTIES.
Dickinson Mfg. Co., Springfield, Mass.

RUNWAYS, Crane.
American Bridge Co., New York.

SAD IRONS. See Flat Irons.

SAL AMMONIAC. See Chemicals.

SCALES, Automatic.
Automatic Packaging Co., Buffalo.
Automatic Weighing Machine Co., Jersey City, N. J.
Avery Scale Co., North Milwaukee, Wis.
The Fairbanks Co., New York.
Pacific Auto Weighing Machine Co., Oakland, Calif.
Richardson Scale Co., New York.
Weston Engineering Co., New York.

SCARFPINS, Electric. (See Toys and Novelties.)

SCRAPERS, Wire. (See Tools, Lineman's.)

SCREWDRIVERS, Insulated Handle, Ratchet.
Benjamin Electric Mfg. Co., Chicago, Ill.
H. W. Johns-Manville Co., New York. (Insulated Handles.)
Smith & Hemenway Co., New York.
Advance Mfg. Co., Pittsburgh, Pa. "Heinz".
Benjamin-Sellar Mfg. Co., Chicago.
Buffalo Specialty Co., Buffalo, N. Y. (Leather Handle.)
Cincinnati Tool Co., Cincinnati, Ohio. "Hargrave".
Henry Disston & Sons, Philadelphia, Pa.
Ducharmes & Co., Shelburne Falls, Mass.
John D. Gould, New York. "Uptodate".
North Bros. Mfg. Co., Philadelphia, Pa. ("Yankee" Ratchet.)
L. S. Starrett Co., Athol, Mass. (Pocket.)

SCREWS, Milled, Machine Screw Products.
American Screw Co., Providence, R. I.
Atlas Bolt & Screw Co., Cleveland, Ohio.
Barnes Co., Wallace, Bristol, Conn.
Chicago Nut Co., Chicago.
Chicago Screw Co., Chicago, Ill.
Clark Novelty Co., Rochester, N. Y.
Elec. Welding Products Co., Cleveland, Ohio.
Hanson Bros., Plainville, Conn.
Hartford Machine Screw Co., Hartford, Conn.
Wm. H. Haskell Mfg. Co., Pawtucket, R. I.
George Q. Hill Co., Boston, Mass.
Justrite Mfg. Co., Chicago.
Estate of F. S. Miles, Philadelphia, Pa.
National Acme Mfg. Co., Cleveland, Ohio.
A. Nelson Mfg. Co., Chicago.
New Haven Machine Screw Co., New Haven, Conn.
Peck & Young Mfg. Co., Forestville, Conn.
Pittsburgh Screw & Bolt Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
St. Louis Screw Co., St. Louis, Mo.
Steele & Johnson Mfg. Co, Waterbury, Conn.
Waterbury Mfg. Co., Waterbury, Conn.

SEALING WAX. See Wax.

SEALS, Meter. For Sealing Electric Meters.
General Electric Co., Schenectady, N. Y.
International Seal Co., Bridgeport, Conn. (Lead.)
Peerless Seal Co., Columbus, Ohio.
Schwerdtle Stamp Co., Bridgeport, Conn.

SEARCH LIGHTS. See Projectors.

SEATS, Pole. See Platforms.

SECOND HAND MACHINERY.
Archer & Baldwin, New York.
Gregory Electric Co., Chicago.
Duseks & Son, New York, N. Y.
Macgovern & Co., New York.
Paul Stewart Co., Cincinnati, O.

SEPARATORS, Steam, Steam Separators, Oil Separators, Grease Extractors.
American District Steam Co., North Tonawanda, N. Y.
Harrison Safety Boiler Works, Philadelphia, Pa. "Cochrane".
Robertson & Sons, J. L., New York, N. Y. "Hine Eliminator".

SERVICE BOXES. See Boxes, Service.

SERVICE SWITCHES. See Switches, Disconnecting.

SETS, Generating. See Engines; also Lighting Plants.

SETS, Testing. See Instruments, testing.

SHADE HOLDERS.
Bridgeport Brass Co., Bridgeport, Conn.
Faries Mfg. Co., Decatur, Ill. (Tungsten Screwless.)
General Electric Co., Schenectady, N. Y.
J. E. M. Shadeholder Co., New York (Screwless).
Western Electric Co., New York.
American Brass & Copper Co., New York. "Acme".
Connecticut Metal Stamping Co., New Haven, Conn. "Eclipse".
Crouse-Hinds Co., Syracuse, N. Y.
The Dale Co., New York.
Harvey Hubbell, Inc., Bridgeport, Conn.
Plume & Atwood Mfg. Co., Waterbury, Conn. "Victor".
Steele & Johnson Mfg. Co., Waterbury, Conn.
Tregoning Electric Mfg. Co., Cleveland, Ohio. (For Tungsten Lamps.)
Universal Shade Holder Co., Shamokin, Pa. "Cruickshank".
Waterbury Mfg. Co., Waterbury, Conn. "Acme".
White Mfg. Co., J. H., Brooklyn.

SHADES, Arc Lamp.
Gill & Co., Inc., Philadelphia, Pa.
Fensterer & Ruhe, New York, N. Y. (Importers.)
Royal Enameling & Stamping Works, Desplaines, Ill.
Wheeler Reflector Co., Boston.

SHADES, Asbestos.
Asbesto-Gleam Mfg. Co., Philadelphia, Pa.

SHADES, Celluloid.
Utility Shade Co., Tenafly, N. J.

SHADES, Glass. (See Glassware.)

SHADES, Leaded or Mosaic.
Western Lamp & Brass Works, Chicago, Ill.
Amboy Works, New York.
American Art Glass Co., Camden, N. J.
Bent Glass Novelty Co., New York.
Braunstein Bros., New York, N. Y.
Chicago Lamp & Fixture Co., Chicago, Ill.
Cleveland Window Glass & Door Co., Cleveland, Ohio.
Colonial Art Glass Co., Chicago.
Detroit Stained Glass Works, Detroit, Mich.
Daggett & Curry Co., Waltham, Mass.
Enterprise Lamp Mfg. Co., New York, N. Y.
Flanagan & Biedenweg Co., Chicago, Ill.
Giannini & Hilgart, Chicago, Ill.
Goodwin & Kintz Co., Winsted, Conn.
Handel Co., Meriden, Conn.
Harchmann Art Glass Co., Milwaukee, Wis.
Imperial Art Glass & Lamp Works, New York, N. Y.
International Shade Co., Springfield, Mass.
Kramer Bros. & Co., New York.
MacBeth-Evans Glass Co., Pittsburgh, Pa. "Iridile", "Bourbonic".
Metallic Mfg. Co., Chicago, Ill.
Mosaic Shade Co., Chicago, Ill.
Neuhauser Co., D. L., Chicago.
Northwestern Chandelier Co., Chicago, Ill.
The Opalescent Bent Glass Co., New York, N. Y.
Propp Co., M., New York, N. Y.
Peltier Glass Co., Ottawa, Ill.
Rayson & Evans Co., Chicago.
Royal Art Glass Co., New York, N. Y.
Schuler Art Glass Co., Chicago.
Stavenhagen Co., W. H., Town of Union, N. J.
Temple Art Glass Co., Chicago.
Tietgen, Falk & Co., Chicago.
Tiffany Studios, New York.
Unique Art Glass & Metal Co. Brooklyn, N. Y. "Imperial".
U. S. Art Glass Co., Hartford, Conn.
Ursom Bros., Cleveland, Ohio.
Western Art Glass Shade Works, San Francisco, Calif.
Whaley & Co., J. A., New York.

SHADES, Metallic.
Benjamin Electric Mfg. Co., Chicago, Ill.
Central Electric Co., Chicago, Ill. "Maxolite".
Cutter Co., Geo., South Bend, Ind.
Faries Mfg. Co., Decatur, Ill.
Federal Sign System (Electric) Chicago, Ill. (Porcelain Enameled.)
W. R. Ostrander & Co., New York.
Pass & Seymour, Inc., Solvay, N. Y.
St. Louis Brass Mfg. Co., St. Louis, Mo.
Adams-Bagnall Electric Co., Cleveland, O. "Abolite".
American Reflector & Ltg. Co., Chicago, Ill. "Tungsten" Window Reflector, "Paragon".
Baltimore Enamel & Novelty Co., Baltimore, Md.
Cary Co., Edward E., New York. (Importers "Prima".)
Chicago Lamp & Fixture Co., Chicago, Ill.
Consolidated Sheet Metal Works, Milwaukee, Wis.
The Dale Co., New York.
Gail-Webb Mfg. Co., Buffalo.
Hatton, L. D., New York, N. Y. (Steel Enameled.)
Herwig Art Lamp Shade Co., Chicago.
Harvey Hubbell, Inc., Bridgeport, Conn.
Klemm & Co., Philadelphia, Pa.
Morse, Frank W., Boston, Mass. "Ideal".
Overbagh & Ayres Mfg. Co., Chicago, Ill. "Oamco".
Philadelphia Elec. & Mfg. Co., Philadelphia, Pa.
Royal Enameling & Stamping Works, Desplaines, Ill.
Tea Tray Co., Newark, N. J.
Vogel & Bros., W., Brooklyn.
Weeks, Nelson, New York.
Western Reflector Co., Chicago, Ill.
Wheeler Reflector Co., Boston, Mass. "Para-Steel".

SHADES, MIRROR. See Reflectors, Mirror.

SHADES, Paper.
Block & Co., L. D., New York.
Mayer & Co., Willy, New York.
Straus-Hohenstein Co., New York, N. Y.
Utility Shade Co., Tenafly, N. J.
Whaley & Co., J. A., New York.

SHADES, SILK.
Lynch Co., Geo. C., New York.
Straus-Hohenstein Co., New York N. Y.
Unique Art Glass & Metal Co., Brooklyn, N. Y.
Whaley & Co., J. A., New York.

SHADES, Street. See Street Lighting Fixtures.

SHAFTS, Flexible.
P R Mfg. Co., Detroit, Mich.
Chicago Flexible Shaft Co., Chicago, Ill.
Coates Clipper Mfg. Co., Worcester, Mass.
Gem Mfg. Co., Pittsburgh, Pa.
Stow Flexible Shaft Co., Philadelphia, Pa.
Stow Mfg. Co., Binghamton, N. Y.

SHAFT STRAIGHTENERS.
Brightman Mfg. Co., Shelby, O.
Columbia Machine Works & Malleable Iron Co., Brooklyn.
Fitchburg Machine Works, Fitchburg, Mass.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Philadelphia Roll & Machine Co., Philadelphia, Pa.
Putman Machine Co., Fitchburg, Mass.
Watson-Stillman Co., New York.

SHEDS, Coal Storage.
American Bridge Co., New York.

SHEDS, Train.
American Bridge Co., New York.

SHEETS, Iron and Steel. (See Metal, Electrical Sheets.)

SHELLS, Chandelier. See Spinnings.

SHIELDS, Linemen's Protecting.
Linemen Protector Co., Detroit, Mich.

SHOE AND LEATHER MACHINERY. (Motor Driven.)
American Electrical Heater Co., Detroit, Mich. (Polishing Irons.)
Boston Last Co., Boston, Mass. ("Peerless Electric Heating and Ironing Outfits.)
Champion Shoe Machinery Co., St. Louis, Mo. (Shoe Repair Outfits.)
Freeman Co., L. G., Cincinnati, Ohio. (Tip Repairers.)
S. M. Supplies Co., Boston, Mass. (Marking Machines.)

SHOE DRIERS.
Hamilton-Beach Mfg. Co., Racine, Wis. "Cyclone".
Sanax Co., Inc., New York. "Foen."

SHOE POLISHERS. See Polishers, Shoe.

SHOW CASE FIXTURES. See Fixtures, Show Case.

SIGNALS, Electric Railway.
Blake Signal & Mfg. Co., Boston, Mass.
Allen Electric Co., Chicago.
American Signal Co., Kansas City, Mo. "Born."
Automatic Signal & Appliance Co., Cleveland, O.
Automatic Train Stop Co., New York.
Beck Automatic Elec. Safety & Signal Switch Co., St. Louis, Mo.
Bossert Mfg. Co., W. F., Utica, N. Y.
Brach Supply Co., L. S., New York. (Crossing Belts.)
Dispatching Signal Co., Fall River, Mass. "Dispatchagraph."
Electric Automatic Railway Safety Signal Co., New York. "Lacroix."
Eureka Automatic Electric Signal Co., Tamaqua, Pa.
Federal Signal Co., Albany, N. Y.
General Railway Signal Co., Rochester, N. Y. "Standard," "Young."
Gill-Alexander Electric Co., Denver.
Hall Ry. Signal Co., New York.
Jordan Automatic Signal Co., New York.
Kinsman Block System Co., New York.
Lintern Car Signal Co., Cleveland, O.
Los Angeles Switch & Signal Co., Los Angeles, Cal.
McFell Electric Co., Chicago.
McGlintock Mfg. Co., St. Paul, Minn.
National Elec'l Mfg. Co., Elgin, Ill.
Northey & Plummer, Indianapolis, Ind. "Simmen."
Painter, G. P., Baltimore, Md.
Richmond Co., Oshkosh, Wis.
Sandwich Electric Co., Sandwich, Ill. "National."
Stromberg - Carlson Telephone Mfg. Co., Rochester, N. Y.
Telegraph Signal Co., Rochester, N. Y.
Union Switch & Signal Co., Swissvale, Pa. "Johnson's," "National."
United States Electric Signal Co., West Newton, Mass. "Ruddick."
Williamson & Co., Allegheny, Pa. "Ramsey."
Wood Co., Chas. N., Boston, Mass. "Chapman."

SIGNALS, Elevator.
Burdett-Rowntree Mfg. Co., Chicago, Ill.
Elevator Supply & Repair Co., Chicago, Ill.
Herzog Teleseme Co., New York.
Holtzer-Cabot Electric Co., Brookline, Mass.
McFell Electric Co., Chicago.
Novelty Electric Co., Philadelphia, Pa.

SIDEWALK SIGN PROJECTORS. See Projectors, Sign.

SIGNALS, Nurse.
Crockett Co., N. P., Chicago, Ill.
Electric Goods Mfg. Co., Canton, Mass.
Holtzer - Cabot Electric Co., Brookline, Mass. (Semaphore.)

SIGNALS, Marine.
Cory & Sons, Charles, New York, N. Y.

SIGN FLASHERS. See Flashers, Sign.

SIGN LETTERS, Porcelain.
Colonial Sign & Insulator Co., Akron, Ohio.

SIGN LIGHTING REFLECTORS.
Reynolds Electric Flasher Mfg. Co., Chicago, Ill.

SIGNS, Electric.
Chicago Glass Novelty Co., Marion, Ind.
Federal Sign System (Electric), Chicago, Ill. "Win-do-Lite."
Phelps Mfg. Co., Detroit, Mich. "New-Est," "Phelps."
Reynolds Electric Flasher Mfg. Co., Chicago, Ill.
Universal Elec. Stage Ltg. Co., New York. "Kliegel Bros."
A. W. R. Elec. Construction Co., New York, N. Y.
A. & W. Electric Sign Co., Cleveland, Ohio. "Walser," "Reflex." (Wireless Panels.)
Advertising Mirrograph Co., Brooklyn, N. Y.
American Electric Sign Co., Boston, Mass.
American Electric Switch Co., Springfield, Mass.
American Sign Co., Inc., Kalamazoo, Mich. "American Lens."
Bailey & Renner, Brooklyn.
Baltimore Enamel & Novelty Co., Baltimore, Md.
Betts & Betts, New York.
Brilliant Mfg. Co., Philadelphia.
Brilliant Sign Co., St. Louis.
Bryan Co., Cleveland, Ohio.
Burdick Enamel Sign Co., Chicago, Ill.
Chase Electric Co., Chicago, Ill. "Chaseco."
Chicago Elec. Co., Chicago, Ill.
Chris Sign & Wall Paper Co., Seattle, Wash.
Colonial Sign & Insulator Co., Akron, Ohio.
Consolidated Elec. Sign Co., Chicago, Ill.
Consolidated Sheet Metal Works, Milwaukee, Wis.
Cusack Co., T., Chicago, Ill.
Dawes Mfg. Co., Braddock, Pa.
Economy Electric Sign Co., Marion, Ind.
Electric Carriage Call & Specialty Co., New York, N. Y. (Universal Monogram Signs.)
Electric Mfg. Co., New Orleans.
Empire Elec. Sign Co., New York, N. Y. "Kaleidoscope".
Enameled Steel Sign Co., Chicago, Ill.
Farr Telephone & Construction Supply Co., Chicago, Ill. "D. & L."
Feature Advertising Co., New York, N. Y. "Ad-o-scope".
Flexlume Sign Co., Inc., Buffalo, N. Y.
Fricker, Frederick, New York.
Frink, I. P., New York, N. Y.
Gillette Electric Co., Chicago.
Globe Electric Specialties Co., New York, N. Y.
Greenwood Advertising Co., Knoxville, Tenn.
Haller Sign Works, Chicago, Ill. "Luna".
Halpern Bros., New York, N. Y.
Hinsdill Electric Co., Troy, N. Y.
W. J. Horn Posting Sign System, Springfield, Ill.
Illuminated Signs Co., Oakland, Cal.
Index Sign Co., New York, N. Y. "Moray".
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
A. Klintz & Co., Chicago, Ill.
L. & S. Electric Co., Bloomington, Ill.
Langever Service, J. J., Fort Worth, Tex.
Lindstrom-Smith Co., Chicago, Ill. "Flash-I-Do".
Marx, Zero, Works, Inc., Chicago.
Metric System, Dayton, Ohio.
Metropolitan Engrg. Co., Brooklyn, N. Y.
Model Sign Works, Philadelphia.
Moore Light Co., Newark, N. J.
Motley Bros. Electric Co., Memphis, Tenn.
National Enameling Co., Cincinnati, Ohio.
Novelty Electric Sign Co., San Francisco, Cal. "Hotchner".
Oliver Roto Co., Chicago, Ill.
Opal Sign Co., New York, N. Y.
Pacific Elec. Co., La Crosse, Wis. "Esperson".
Paige, Lucius R., Worcester, Mass.
Pause & Co., P., Chicago, Ill. (Glass Only.)
Perry Electrical Works, Los Angeles, Calif. (Talking Signs.)
Pittsburg Elec'l Specialty Co., Pittsburgh, Pa. (Projector.)
Providence Electric Mfg. Co., Providence, R. I.
Pyro Sign Co., New York, N. Y.
R. R. Sign Co., Dayton, Ohio.
Rawson & Evans Co., Chicago, Ill.
Republic Sign & Advertising Co., Buffalo, N. Y.
Rice Co., Geo. H., Brooklyn.
Robison Co., S. H., Philadelphia.
Royal Enameling & Stamping Works, Desplaines Ill.
Ruby Mfg. Co., Jackson, Mich.
Solar Electric Co., Chicago, Ill. "Canteen".
Strauss & Co., New York, N. Y.
Tech Sign & Deco Co., McKeesport, Pa.
Tripp & Co., Chicago, Ill.
Valentine Elec. Sign Co., Atlantic City, N. J.
Vallee Electric Co., Geo. W., Atlantic City, N. J.
Wall-Win Co., Jersey City, N. J. (Mason Monogram Talking Signs.)
Weber Illuminating Sign Co., Reading, Pa.
Western Display Co., St. Paul, Minn. "Reflectric".
Western Sand Blast Mfg. Co., Chicago, Ill.
P. F. Yoerger Sign Co., Columbus, Ohio.

SILK, Insulating. See Yarn and Thread.

SLATE.
Sundh Electric Co., New York.
Durick & Flanagan Co., Fair Haven, Vt.
Durick, Keenan & Co., Fair Haven, Vt.
Jones & Francis, Fairhaven, Vt.
McNamara Bros., Fair Haven, Vt.
Maley, M. K., Fair Haven, Vt.
O'Day Bros., Hydeville, Vt.
Penrhyn Slate Co., Hydeville, Vt.
Portland-Monson Slate Co., Portland, Me.
Vermont Unfading Green Slate Co., Fair Haven, Vt.
Young Co., A. B., Fair Haven, Vt.

SLEEVINGS, Woven.
Belden Mfg. Co., Chicago, Ill.
Chicago Mica Co., Valparaiso, Ind.
Standard Underground Cable Co., Pittsburgh, Pa.
Hope Webbing Co., Providence, R. I.

SLEEVES, Paper.
Standard Underground Cable Co., Pittsburgh, Pa.
Fairpont Corp., New Bedford, Mass.
Reliable Electric Co., Chicago.
Sherwin, Geo. D., Burlington, Vt. (Bushings.)
Stone Straw Co., Washington, D. C.

SLEEVES, Pole Repair.
Pittsburg Reinforced Pole Co., Pittsburgh, Pa. (Reinforcing Wooden Poles.)
Railway Track Work Co., Philadelphia, Pa.

SLEEVES AND HEADS. See Potheads.

SLEEVING AND TAPE, Cotton.
Johns-Manville Co., H. W., New York, N. Y. (Asbestos.)
Tubular Woven Fabric Co., Pawtucket, R. I.
Anchor Webbing Co., Woonsocket, R. I.
Dunton Co., M. W., Providence, R. I.
Hope Webbing Co., Pawtucket, R. I.
Neidner's Sons Co., C., Maiden, Mass.
Rosendale-Reddaway Belting & Hose Co., Newark, N. J.
Textile Tube Co., Fall River, Mass.

SLOTTING MACHINES. See Machines.

SOAPSTONE, Switchboard.
Alberene Stone Co., New York.
Old Dominion Soapstone Corporation, Esmont, Va.
Williams & Co., Nashua, N. H.

SOCKETS AND RECEPTACLES. Automobile Lamp.
Chicago Electric Mfg. Co., Chicago.
Frank W. Morse, Boston, Mass.

SOCKETS AND RECEPTACLES. Miniature and Candelabra.
Arrow Electric Co., Hartford, Conn. "Arrow E."
General Electric Co., Schenectady, N. Y.
Pass & Seymour, Inc., Solvay, N. Y.
American Miniature & Decorative Lamp Co., New York.
Bryant Electric Co., Bridgeport, Conn.
Electric Mfg. Co., Baltimore.
Electro Importing Co., New York. (Importers.)
Franco-American Electric Novelty Co., New York, N. Y.
Harvey Hubbell, Inc., Bridgeport, Conn.
Industrial Novelty Co., Chicago, Ill. (Importers.)
McCandless & Co., H. W., New York, N. Y.
Mitchell-Vance Co., New York.
Vosburgh Miniature Lamp Co., West Orange, N. J.
John J. Waldman, New York.

SOCKETS AND RECEPTACLES. Standard Brass, Pull Chain, Porcelain, Waterproof, Weatherproof, Regulating, Series.
Arrow Electric Co., Hartford, Conn.
Arrow Electric Co., Hartford, Conn. "Arrow E."
Benjamin Electric Mfg. Co., Chicago, Ill. "Bence".
Central Electric Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis. (Push Button.)
Federal Sign System (Electric), Chicago.
General Electric Co., Schenectady, N. Y. "Multi-Catch".
Pass & Seymour, Inc., Solvay, N. Y. "Passmour", "Pluto."
Phelps Mfg. Co., Detroit, Mich. ("Phelps" Pull Socket.)
Union Electric Co., Trenton, N. J.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Advance Mfg. Co., Pittsburgh.
Bryant Electric Co., Bridgeport, Conn. "Bragdon," "New Wrinkle."
Connecticut Electric Mfg. Co., Bridgeport, Conn. (Porcelain and rubber shell only.)
Freeman Electric Co., E. H. Trenton, N. J. "Russell".
Hubbell, Inc., Harvey, Bridgeport, Conn. (Pull Sockets.)
Knowles, C. S., Boston, Mass. "Wirt".
Philadelphia Elect. Mfg. Co., Philadelphia, Pa.
Tregoning Electric Mfg. Co., Cleveland, Ohio. (Cleat Receptacles.)
Weber Electric Co. (Henry D. Sears, General Sales Agent, Boston, Mass.) ("Universal" Snap Shell.)
Yost Electric Mfg. Co., Toledo, O.

SOCKETS AND RECEPTACLES, Special.
Johns-Manville Co., H. W., New York, N. Y. (Moulded Mica Waterproof.)
Trumbull Electric Mfg. Co., Plainville, Conn. "Circle T" (Weatherproof).
Union Electric Co., Trenton, N. J.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. (Flashing Sockets.)
Wirt Co., Philadelphia, Pa. ("Dim-a-lite" Regulating.)
Adams-Bagnall Electric Co., Cleveland, Ohio. ("Abolites" Shades and Sockets.)
Crouse-Hinds Co., Syracuse, N. Y.
Dickinson Mfg. Co., Springfield, Mass. (Weatherproof.)
C. S. Knowles, Boston, Mass.
Mechanical & Electrical Mfg. Co., Chicago, Ill. ("Memco" Weatherproof.)
Metal Specialties Mfg. Co., Chicago, Ill. (Spring.)
Peru Electric Co., Peru, Ind. (Weatherproof.)
Philadelphia Electrical & Mfg. Co., Philadelphia, Pa. (Series.)
Siemon Hard Rubber Corporation, Bridgeport, Conn. (Waterproof.)
Yost Electric Mfg. Co., Toledo, Ohio.

SOCKETS, Locking.
Pass & Seymour, Inc., Solvay, N. Y. "Shurlok."
Rail, Frederick, New York, N. Y.

SOCKETS, Magnetic.
Federal Sign System (Electric), Chicago, Ill. (Magnetic Clamp.)
Aurora Electric Co., Aurora, Ind. (Electro-Magnetic.)
Stiles & Co., H. A., Boston, Mass. ("Collom" Magnetic Lamp Holder.)

SOCKETS, Sign. (See Receptacles, Sign.)

SOCKET ADAPTERS. See Adapters, Lamp.

SOCKET ATTACHMENTS. See Attachments.

SOCKET EXTENSIONS. See Extensions, Socket.

SOCKET HANDLES. See Handles, Socket.

SOCKET KEYS. See Insulation, Molded.

SOCKET PULLS. See Attachments.

SOLDER, Aluminum.
Aluminum Solder & Refining Co., Oswego, N. Y. "Iluminite."
Clum & Atkinson, Rochester, N. Y.
International Solder Co., Syracuse, N. Y.
Reinhold Noflux Aluminum Solder Co., Newark, N. J.
Thwing Co., C. B., Philadelphia, Pa.
Universal Fluxine Co., Urbana, Ohio.

SOLDER, Self Fluxing.
Belden Mfg. Co., Chicago, Ill.
Kellogg Switchboard & Supply Co., Chicago, Ill.
Western Electric Co., New York. "Hawthorn".

L. B. Allen & Co., Inc., Chicago.
Chicago Solder Co., Chicago, Ill. "Kester".
The National Lead Co., New York, N. Y.

SOLDERING FLUX. See Fluxes, Soldering.

SOLDERING IRONS, Electric. Soldering Coppers, Branding Irons.

Manhattan Electrical Supply Co., New York.
Simplex Electric Heating Co., Cambridge, Mass.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Acme Electric Heater Co., Detroit, Mich. (Branding Irons, Sad Irons.)
Economy Electric Co., Brooklyn, N. Y. (Soldering, Branding.)
Nilson & Dillenbeck Co., Chicago, Ill. (Soldering Irons.)
Vulcan Electric Mfg. Co., Chicago.
Ward Leonard Electric Co., Bronxville, N. Y.

SOLENOIDS. See Magnets, Electro.

SPARK COIL BOXES. See Boxes, Spark Coil.

SPARK COILS. See Coils.

SPARKING POINTS. See Platinum.

SPEAKING TUBES. (See Tubes, Speaking.)

SPEEDOMETERS. (See Tachometers.)

SPINNINGS. (For Fixture Parts.)

Bridgeport Brass Co., Bridgeport, Conn.
Faries Mfg. Co., Decatur, Ill.
American Spinning & Sheet Metal Works, Chicago.
Art Brass & Fixture Mfg. Co., McKees Rocks, Pa.
East Side Metal Spinning Co., New York, N. Y.
Gethberg Brass Works, H. & E., Jersey City, N. J.
Goshen Stamping & Brass Co., Goshen, Ind.
Manhattan Brass Co., New York.
Parker Co., John L., Worcester, Mass.
Philadelphia Elect. Mfg. Co., Philadelphia, Pa.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rome Brass & Copper Co., Rome, N. Y.
Safety Lamp & Metal Mfg. Co., Pittsburgh, Pa.
Scovill Mfg. Co., Waterbury, Conn.
Simplex Railway Appliance Co., Hammond, Ind.
Standard Metal Spinning Co., New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Virden Mfg. Co., Cleveland, Ohio. (Pendents.)
Vogel & Bros., W., Brooklyn, N. Y.
Waterbury Brass Co., Waterbury, Conn.
Weber Bros. Chicago, Ill.
J. H. White Mfg. Co., Brooklyn.

SPLICERS, Socket Chain.

McKenney & Waterbury Co., Boston, Mass. "Harrigan".

SPLICING CLAMPS.

Mathias Klein & Sons, Chicago, Ill.
Smith & Hemenway Co., New York.
Advance Mfg. Co., Pittsburgh, Pa. "Heinze".
Cincinnati Tool Co., Cincinnati, Ohio. "Hargrave".
Cronk & Carrier Mfg Co., Elmira, N. Y.
Dicke Tool Co., Downers Grove, Ill.
P. Lowentraut Mfg. Co., Newark, N. J.

SPLICING GUM. See Tape.

SPLICING JOINTS, CABLE. (See Cable Splicing Joints.)

SPRINGS.

American Platinum Works, Newark, N. J.
American Steel & Wire Co., Chicago, Ill.
A. B. C. Spring Co., New York.
Wallace Barnes Co., Bristol, Conn.
Cary Spring Works, New York.
Cleveland Wire Spring Co., Cleveland, Ohio.
Detroit Wire Spring Co., Detroit.
Dunbar Bros. Co., Bristol, Conn.
Farrington & Co., Mt. Vernon, N. Y.
Chas. Fischer Spring Co., New York.
Fort Pitt Spring & Mfg. Co., Pittsburgh, Pa.
Wm. D. Gibson Co., Chicago, Ill.
George A. Hepp, Newark, N. J.
M. D. Hubbard Spring Co., Pontiac, Mich.
Independent Steel & Wire Co., Chicago, Ill.
F. N. Manross & Sons, Forestville, Conn. (Hair Springs.)
Morgan Spring Co., Worcester, Mass.
Peck & Young Mfg. Co., Forestville, Conn.
Raymond Mfg. Co., Corry, Pa.

STACKS.

American Bridge Co., New York.

STAGE DIMMERS. See Rheostats.

STAGE LIGHTING APPARATUS.

A. & J. M. Anderson Mfg. Co., Boston, Mass.
General Electric Co., Schenectady.
H. W. Johns-Manville Co., New York, N. Y.
Sundh Electric Co., New York.
Universal Electric Stage Lighting Co., New York. "Kliegl Bros."
Chicago Stage Lighting Co., Chicago.
Globe Electric Specialties Co., New York.
Overbagh & Ayres Mfg. Co., Chicago, Ill.

STAGE PLUGS AND RECEPTACLES.

General Electric Co., Schenectady.
Universal Electric Stage Lighting Co., New York. "Kliegl Bros."
Chase-Shawmut Co., Newburyport, Mass.
Electric Mfg. Co., New Orleans, La.
J. Lang Electric Co., Chicago.
Russell & Stoll Co., New York.

STAIRWAYS, Movable Electric.

Otis Elevator Co., New York.

STANDARD CELLS.

Leeds & Northrup Co., Philadelphia, Pa.
Weston Electrical Instrument Co., Newark, N. J.

STANDS, Armature. See Machines, Armature.

STAPLE DRIVER.

McIntire & Co., Port Chester, N. Y.
I. S. Spencer's Sons, Guilford, Conn.

STAPLES AND TACKS, Plain.

Grand Crossing Tack Co., Grand Crossing, Ill.
Morgan Spring Co., Worcester, Mass.
E. H. Titchener & Co., Binghamton, N. Y.
Wright Wire Co., Worcester, Mass.

STAPLES AND TACKS, Insulating.

Blake Signal & Mfg. Co., Boston, Mass. (Fibre Staples and Wood Knobs.)
Elastic Tip Co., Boston, Mass.
Eureka Supply Co., Sewall, N. J.
James Goldmark Co., New York, N. Y. (Sole Selling Agents "Cross.")
Insulating Saddle Staple Co., Brockton, Mass.
Morley Mfg. Co., Boston, Mass. ("Milanite Perfection" Nail.)

STARTERS, Electric Motor. For A. C. Motors, see Auto-Starters; for D. C. Motors, see Rheostats, Motor Controlling.

STATIC MACHINES. See Medical Apparatus.

STATIONS, Coaling.

American Bridge Co., New York.

STATIONS, Elevated Railway.

American Bridge Co., New York.

STEEL, Armature. See Iron and Steel.

STEEL, Structural and Tool.

American Bridge Co., New York.
Baltimore Bridge Co., Baltimore.
Bellefontaine Bridge & Steel Co., Bellefontaine, O.
Belmont Iron Works, Philadelphia, Pa.
The Berlin Construction Co., Berlin, Conn.
Boston Bridge Works, Boston.
Wm. Jessop & Sons, Inc., New York. "Ark."
Kenwood Bridge Co., Chicago.
King Bridge Co., Cleveland, O.
Pennsylvania Steel Co., Steelton, Pa.
Phoenix Bridge Co., Philadelphia, Pa.
Riverside Bridge Co., Martins Ferry, O.
Vierling Steel Works, Chicago.
Wisconsin Bridge & Iron Co., Milwaukee, Wis.

STEREOPTICONS.

General Electric Co., Schenectady.
Universal Electric Stage Lighting Co., New York. "Kliegl Bros."
Electric Stage Lighting Co., Chicago, Ill.
Arthur W. Fox, Brooklyn, N. Y.
Globe Electric Specialties Co., New York.
McIntosh Stereopticon Co., Chicago.
Jos. Menchen Elec. Co., New York.
C. I. Newton, New York.
Victor Animatograph Co., Davenport, Ia.
Victor Electric Co., Chicago.

STERILIZERS, Instrument.

Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Simplex Electric Heating Co., Cambridge, Mass.
American Electrical Heater Co., Detroit, Mich.
Presto Electrical Mfg. Co., San Francisco, Cal.

STERILIZERS, Water, Electric.

American Ozone Co., Niagara Falls, N. Y. "Ozosure".

STICKS, Switch.

Strieby & Foote Co., Newark, N. J.

STOCKS, DIES, REAMERS. (See Pipe Fitting Tools.)

STOKERS, Automatic.

Babcock & Wilcox Co., New York.
Westinghouse Machine Co., New York.
American Engineering Co., Philadelphia, Pa.
American Ship Windlass Co., Providence, R. I.
Underfeed Stoker Co., Chicago, "Jones".

STOKERS, Mechanical.

Babcock & Wilcox Co., New York.
Westinghouse Machine Co., Pittsburgh, Pa.. "Roney".

STONES, Commutator.

Cleveland Stone Co., Cleveland, Ohio.

STOPS, Engine.

Consolidated Engine Stop Co., New York. "Corliss", "Monarch".
Thos. P. Ford Co., New York.
Locke Regulator Co., Salem, Mass.
Morigrieve Engrng. Co., New York.
Strong, Carlisle & Hammond Co., Cleveland, Ohio.
Union Stop & Signal Co., Fall River, Mass. "Hart & Palmer".

STORAGE BATTERIES. See Batteries, Storage.

STOVES, Electric. See Cookers, Heaters, Fireless Cookers, Radiators.

STRAIGHTENERS, Shaft. See Shaft.

STRAIGHTENERS, Wire.

John P. Haga, Minneapolis, Minn.

STRAIN INSULATORS.

Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Barnes & Kobert Mfg. Co., New Haven, Conn.
General Electric Co., Schenectady, New York.
H. W. Johns-Manville Co., New York.
Ohio Brass Co., Mansfield, Ohio.
St. Louis Malleable Iron Co., St. Louis, Mo.

STRAIN RELIEF GRIPS. See Grips.

STRAPS, Jack. See Tools, Lineman's.

STRAPS, Pipe. See Hangers and Clamps.

STREETHOODS.

Geo. Cutter Co., South Bend, Ind.
Line Material Co., South Milwaukee, Wis.
Philadelphia Elect. Mfg. Co., Philadelphia, Pa.

STREET LIGHTING FIXTURES, Incandescent.

Benjamin Electric Mfg. Co., Chicago, Ill.. "Parabolite" for Mazda Street Lamps.
Brady Electric Mfg. Co., New Britain, Conn.
Central Electric Co., Chicago, Ill.
Geo. Cutter Co., South Bend, Ind.
Federal Sign System (Electric), Chicago.
Fort Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady.
Line Material Co., South Milwaukee, Wis.
Pittsburgh Transformer Co., Pittsburgh, Pa.
American Reflector & Lighting Co., Chicago.
Delta-Star Electric Co., Chicago.
Fletcher Mfg. Co., Dayton, Ohio.
Harvey Hubbell, Inc., Bridgeport, Conn.
Klemm & Co., Philadelphia, Pa.
F. H. Lovell & Co., Arlington, N. J. (Gooseneeks.)
Lundin Electric & Machine Co., Boston, Mass.
Overbagh & Ayres Mfg. Co., Chicago, Ill. "Oamco".
Pettingell-Andrews Co., Boston, Mass. (Insulators only.)
Philadelphia Elec. & Mfg. Co., Philadelphia, Pa.
Risinger Mfg. Co., East Liverpool, Ohio.
H. C. Roberts Electric Supply Co., Philadelphia, Pa.
Tea Tray Co., Newark, N. J.
Walworth Mfg. Co., Boston, Mass. (Goosenecks.)
Wheeler Reflector Co., Boston, Mass.

STREET LIGHTING SYSTEMS. See Transformers, Constant, Potential.

STRETCHERS, Wire. See Comealongs.

STUDS, Fixture (Hickies, Stems and Studs.)

Appleton Electric Co., Chicago.
Bossert Co., Utica, N. Y.
Sprague Electric Works, New York.
Steel City Electric Co., Pittsburgh, Pa. "Star", "Fullman".
Thomas & Betts Co., New York. "T. & B."
Barlow Foundry Co., Newark, N. J.
Wm. H. Colgan Co., West Newton, Mass. "Rex".
S. R. Fralick & Co., Chicago. "Kwikon."
Grabler Mfg. Co., Cleveland, Ohio.
Macallen Co., Boston, Mass.

STRUCTURES, Subway.

American Bridge Co., New York.

SUB-BASES, for Snap Switches. See Bases.

SUPPLIES, Electrical.

Bissell & Co., F., Toledo, O.
Central Electric Co., Chicago.
Commonwealth Edison Co., Chicago, Ill.
Federal Sign System, (Electric), Chicago.
Illinois Electric Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York.
M. Rutkin, New York.
Stanley & Patterson, New York.
Western Electric Co., New York.

SUPPORTS, Cross Arms.

St. Louis Malleable Casting Co., St. Louis, Mo.
Hallet Iron Works, Chicago, Ill.

SURGICAL APPLIANCES. See Medical.

SURFACES. See Floor Cleaners and Polishers.

SWITCHBOARDS. (Switchboards and Panel Boards.)

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Electric Controller & Mfg. Co., Cleveland, O.
Ft. Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady, N. Y.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Agutter & Griswold Co., Seattle, Wash. ("A. G." Universal Metering Panel.)
Almstead Mfg. Co., Rochester, N. Y.
American Electric Switch Co., Springfield, Mass.
J. Andrae & Sons Co., Milwaukee, Wis.
B. & C. Electrical Construction Co., Utica, N. Y. ("B. C." Panels.)
Baseler & Heineken, Camden, N. J.
Butte Engineering & Elec. Co., San Francisco, Cal.
Clark & Harvey, Dayton, Ohio.
Cleveland Switchboard Co., Cleveland, Ohio.
Commercial Switchboard Mfg. Co., Denver, Colo.
Delta-Star Electric Co., Chicago.
Drendell Elec'l & Mfg. Co., San Francisco, Cal.
Electric Mfg. Co., New Orleans.
Fairbanks, Morse & Co., Chicago.
Fisher Electrical Works, Detroit.
Hewitt & Warden, Newburgh, N. Y.
Holabird-Reynolds Elec. Co., Los Angeles, Cal. "H. R."
Indianapolis Elec. Supply Co., Indianapolis, Ind. "Royse".
Interstate Elec. & Mfg. Co., Sioux City, Iowa.
H. Krantz Mfg. Co., Brooklyn, N. Y.
Kurz & Root, Appleton, Wis.
J. Lang Electric Co., Chicago. (McWilliams Metering Panels.)
Leonard-Bundy Elec. Co., Cleveland, Ohio.
W. R. Luckie, Houston, Tex.
McCarthy Bros. & Ford, Buffalo.
McNamara Bros., Fair Haven, Vt.
Minnesota Electric Co., Minneapolis, Minn.

Mutual Electric & Machine Co., Wheeling, W. Va.
National Switchboard Co., New York.
Pike Elec. Mfg. Co., Anoka, Minn.
Pittsburgh Electrical & Machine Works, Pittsburgh, Pa.
L. H. Neilsen Co., Pittsburgh, Pa. ("Nico" Panelboard.)
Henry Newgard & Co., Chicago.
Newport Electric Mfg. Co., Newport, Ky. (Schrimp Box.)
Nyelec Switchboard Co., New York.
Penn Electric & Mfg. Co., Irwin, Pa.
Post-Glover Electric Co., Cincinnati, Ohio.
Rochester Switchboard Co., Rochester, N. Y.
H. I. Sacket Elec'l Co., Buffalo.
Schaefer Bros. Co., Chicago, Ill.
States Electric Co., Chicago, Ill.
Stecker Electric & Machine Co., Detroit, Mich.
W. M. Steel Switchboard Co., Worcester, Mass.
Taunton - New Bedford Copper Co., Taunton, Mass.
Troy Elec'l Co., Troy, N. Y.
Walker Elec. Co., Philadelphia.
H. P. White & Co., Ltd., Wayne Junction, Pa.
Woodill & Hulse Elec. Co., Los Angeles, Cal.
Worcester Electric & Mfg. Co., Worcester, Mass.
Wm. Wurdack Electric Mfg. Co., St. Louis, Mo.

SWITCHBOARDS, Telephone. See Telephones.

SWITCHBOARDS, Theatre.
Adam Electric Co., Frank, St. Louis, Mo.
Trumbull Electric Mfg. Co., Plainville, Conn.
Universal Electric Stage Lighting Co., New York. "Kliegl Bros."
Crouse-Hinds Co., Syracuse, N. Y.
Electric Apparatus Co., Chicago.
Electric Stage Lighting Co., Chicago, Ill.
Jos. Menchen Elec. Co., New York.
Mutual Elec. & Mach. Co., Wheeling, W. Va.
J. S. Pennefather, New York.
Walker Electric Co., Philadelphia, Pa.

SWITCHBOARD CLEANERS. See Cleaners.

SWITCH BOXES. See Boxes, Conduit.

SWITCH STICKS. See Sticks.

SWITCHES AND CUT-OUTS, Battery.
Manhattan Electrical Supply Co., New York.
Ostrander & Co., W. B., New York, N. Y.
Trumbull Elec. Mfg. Co., Plainville, Conn.
American Specialty Co., Syracuse, N. Y.
Chicago Electric Mfg. Co., Chicago, Ill. "Handy".
Connecticut Electric Mfg. Co., Bridgeport, Conn.
Connecticut Tel. & Electric Mfg. Co., Meriden, Conn.
Electric Goods Mfg. Co., Canton, Mass. (Automatic Sectional.)
Holtzer - Cabot Electric Co., Brookline, Mass.
Francis Keil & Son, New York. "Anti-Wood".
Knoblock-Heideman Mfg. Co., South Bend, Ind.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Voltamp Electric Mfg. Co., Baltimore, Md.

SWITCHES, Automobile, Push Button.
Arrow Electric Co., Hartford, Conn. "Arrow E."
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn. "Diamond H."
Manhattan Electrical Supply Co., New York, N. Y.
National Carbon Co., Cleveland, Ohio.
Chicago Electric Mfg. Co., Chicago, Ill. "Handy".
Hart & Hegeman Mfg. Co., Hartford, Conn. "H. & H."
Leece-Neville Co., Cleveland.
Frank W. Morse, Boston, Mass.
Northeast Electric Co., Rochester, N. Y.
Jos. F. O'Brien Co., New York.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Pittsfield Spark Coil Co., Dalton, Mass.

SWITCHES, Canopy.
Benjamin Electric Mfg. Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Pass & Seymour, Inc., Solvay, N. Y.

SWITCHES, Ceiling.
H. Krantz Mfg. Co., Brooklyn, N. Y.
Charles W. Leveridge, New York. "L. & L."
P. Sorensen, Brooklyn, N. Y.
Tirrill Mfg. Co., Athens, Pa.
John J. Waldman, New York. "Jones-Perfection".

SWITCHES, Combination Cut-Outs.
Detroit Fuse & Mfg. Co., Detroit, Mich.
D & W Fuse Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
H. W. Johns-Manville Co., New York.
W. N. Matthews & Bro., St. Louis, Mo.
National Metal Molding Co., Pittsburgh, Pa.
H. T. Paiste Co., Philadelphia.
Trumbull Electric Mfg. Co., Plainville, Conn.
Barkelew Electric Mfg. Co., Middletown, Ohio.
Bryant Electric Co., Bridgeport, Conn.
Connecticut Electric Mfg. Co., Bridgeport, Conn.
Geo. Heinemann & Co., Philadelphia, Pa.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Worcester Electric Mfg. Co., Worcester, Mass.

SWITCHES, Disconnecting.
Allis - Chalmers Manufacturing Co., Milwaukee, Wis.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
D & W Fuse Co., Providence, R. I.
Detroit Fuse & Mfg. Co., Detroit, Mich. (Fuse Switch Boxes.)
Electric Controller & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady, N. Y.
Hickey & Schneider, New York, N. Y.
H. W. Johns-Manville Co., New York. "Noark".
W. N. Matthews & Bro., St. Louis, Mo.
Trumbull Electric Mfg. Co., Plainville, Conn.
Bowie Switch Co., San Francisco, Cal.
Condit Elec'l Mfg. Co., Boston, Mass.
Cuthbert Electric Mfg. Co., Chicago, Ill.
Delta-Star Elec. Co., Chicago.
Empire Electric Mfg. Co., Plainville, Conn.
G. & W. Electric Specialty Co., Chicago, Ill.
Kalenborn Pahl & Francis, San Francisco, Cal.
Kelman Elec. & Mfg. Co., Los Angeles, Cal.
Lord Mfg. Co., New York.
Pacific Elec. & Mfg. Co., San Francisco, Cal.
Railway & Industrial Engineering Co., Pittsburgh, Pa. "Burke".
States Electric Co., Chicago, Ill.
Walker Electric Co., Philadelphia, Pa.
Worcester Electric & Mfg. Co., Worcester, Mass.

SWITCHES, Door. See Door Switches.

SWITCHES, Fixture.
Benjamin Electric Mfg. Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Pass & Seymour, Inc., Solvay, N. Y.
Bryant Electric Co., Bridgeport, Conn.
E. F. Caldwell & Co., New York.
The Dale Co., New York, N. Y.
Harvey Hubbell, Inc., Bridgeport, Conn.
The Mitchell - Vance Co., New York.
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Sterling Bronze Co., New York. "Wagner Reversible".
Wi-Ko Electric Co., Chicago.

SWITCHES, Gas Engine, Ignition.
Manhattan Electric Supply Co., New York.
Trumbull Electric Mfg. Co., Plainville, Conn.
Apple Electric Co., Dayton, Ohio.
Chicago Electric Mfg. Co., Chicago, Ill. "Handy".
Connecticut Telephone & Electric Co., Meriden, Conn.
Dow Mfg. Co., Braintree, Mass.
Edwards & Co., New York.
Empire Electric Mfg. Co., Plainville, Conn.
Knoblock-Heideman Mfg. Co., South Bend, Ind.
Kokomo Electric Co., Kokomo, Ind. "Kingston".
Frank W. Morse, Boston, Mass.
Motsinger Device Mfg. Co., Lafayette, Ind. "Faultless".
Pittsfield Spark Coil Co., Dalton, Mass.
C. F. Splitdorf, New York.
Witherbee Igniter Co., Springfield, Mass.

SWITCHES, Knife.
Frank Adam Electric Co., St. Louis, Mo.
Albert & J. M. Anderson Mfg. Co., Boston, Mass. ("Hancock", "Ajax" Switches.)
Bissell Co., F., Toledo, Ohio. "Security".
Central Electric Co., Chicago, Ill. "Central H."
Columbia Metal Box Co., New York, N. Y.
Crocker-Wheeler Co., Ampere, N. J. "Remek".
Electric Controller & Mfg. Co., Cleveland, Ohio.
Ft. Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady.
Machen & Mayer Electrical Mfg. Co., Philadelphia, Pa. "M. & M."
Manhattan Electrical Supply Co., New York.
Menominee Electric Mfg. Co., Menominee, Mich. "Davis".
H. T. Paiste Co., Philadelphia, Pa.
Trumbull Electric Mfg. Co., Plainville, Conn.
Western Electric Co., New York.
W. nghouse Elec. & Mfg. Co., Pittsburgh, Pa.
Agutter - Griswold Co., Seattle, Wash.
Barkelew Electric Mfg. Co., Middletown, Ohio. ("Premo", "Star" Switches.)
Baseler & Heineker, Camden, N. J.
E. G. Bernard Co., Troy, N. Y.
Blake Electric Mfg. Co., Boston, Mass. "Macfarlane".
Bryant Electric Co., Bridgeport, Conn.
Burke Electric Co., Erie, Pa.
Connecticut Electric Mfg. Co., Bridgeport, Conn.
Cleveland Switchboard Co., Cleveland, Ohio.
Crouse-Hinds Co., Syracuse, N. Y. "Colonial".
Cuthbert Electrical Mfg. Co., Chicago, Ill.
Delta-Star Electric Co., Chicago.
Electric Mfg. Co., New Orleans.
Empire Elec. & Mfg. Co., Plainville, Conn.
J. P. Mfg. Co., Niverville, N. Y.
J. Lang Electric Co., Chicago, Ill. ("Paragon", "McWilliams" and "Universal" Switches.)
H. Krantz Mfg. Co., Brooklyn, N. Y.
Leonard - Bundy Electric Co., Cleveland, O.
Lundin Elec. & Mach. Co., Boston, Mass.
Metropolitan Elec. Mfg. Co., Long Island City, N. Y.
Metropolitan Switchboard Co., New York.
Milwaukee Vault & Elec. Cabinet Box Co., Milwaukee, Wis.
Mutual Electric & Machine Co., Wheeling, W. Va. "Bull Dog".
New Haven Electric Mfg. Co., North Haven, Conn.
Penn. Elec'l & Mfg. Co., Irwin, Pa.
Perkins Elec. Switch Mfg. Co., Bridgeport, Conn.
Pittsburgh Electrical & Mach. Works, Pittsburgh, Pa.
Post-Glover Electric Co., Cincinnati, Ohio.
Pringle Electric Mfg. Co., Philadelphia, Pa.
Taunton - New Bedford Copper Co., Taunton, Mass. "Hill".
Trio Mfg. Co., Rock Island, Ill.
Troy Electrical Co., Troy, N. Y.
Walker Electric Co., Philadelphia, Pa.
Worcester Electric & Mfg. Co., Worcester, Mass.
Wm. Wurdack Elec. Mfg. Co., St. Louis, Mo.

SWITCHES, Marine. See Fixtures, Marine.

SWITCHES, Oil Break.
Allis - Chalmers Manufacturing Co., Milwaukee, Wis.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Campbell Electric Co., Lynn, Mass.
General Electric Co., Schenectady.
Hart Mfg. Co., Hartford, Conn.
High Tension Electrical Specialty Co., West Newton, Mass.
Westinghouse Electric Mfg. Co., E. Pittsburgh, Pa.
Condit Elec'l Mfg. Co., Boston, Mass. "Cushing".
Hartman Circuit Breaker Co., Mansfield, Ohio.
Kelman Elec. & Mfg. Co., Los Angeles, Calif.

SWITCHES, Pendant.
Arrow Electric Co., Hartford, Conn. "Arrow E."
Benjamin Electric Mfg. Co., Chicago, Ill.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady.
Machen & Mayer Elec'l Mfg. Co., Philadelphia, Pa. "M. & M."
Pass & Seymour, Inc., Solvay, N. Y.
Eclipse Electric Arc Lamp Co., New York.
G. & W. Specialty Co., Chicago.
Harvey Hubbell, Inc., Bridgeport, Conn. (Chain Pull.)
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.

SWITCHES, Remote Control.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, Ohio.
General Electric Co., Schenectady.
Hart Mfg. Co., Hartford, Conn. "P. M."
Sundh Electric Co., New York.
Automatic Switch Co., New York. "Darrin".
Kelman Elec. & Mfg. Co., Los Angeles, Calif.
Walker Electric Co., Philadelphia, Pa.

SWITCHES, Snap, Flush, Push Button, Rotary.
Arrow Electric Co., Hartford, Conn. "Arrow E."
Chelton Electric Co., Philadelphia, Pa.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Cutter Co., Philadelphia, Pa. ("C. S." Push Button.)
General Electric Co., Schenectady.
Hart Mfg. Co., Hartford, Conn. "Diamond H.", "Hartford".
Machen & Mayer Electrical Mfg. Co., Philadelphia, Pa. ("M. & M." Push Button.)
Manhattan Electrical Supply Co., New York.
Trumbull Electric Mfg. Co., Plainville, Conn.
Bryant Electric Co., Bridgeport, Conn.
Chicago Electric Mfg. Co., Chicago, Ill. (For low voltages only.)
Hart & Hegeman Mfg. Co., Hartford, Conn. "Nutmeg", "H. & H."
C. S. Knowles, Boston, Mass. "N. E." Push Button Switch.
H. Krantz Mfg. Co., Brooklyn, N. Y. "Rusby".
Metropolitan Elec. Mfg. Co., Long Island City, N. Y. (Detachable Push Button.)
Perkins Electric Switch Mfg. Co., Bridgeport, Conn.
Pittsburgh Electrical & Machine Works, Pittsburgh, Pa.
Standard Elec. Mfg. Co., Chicago, Ill.
Tirrill Mfg. Co., Athens, Pa.
J. J. Waldman, New York.

SWITCHES, Tank. See Tank Switches.

SWITCHES, Time, Automatic.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
F. Bissell Co., Toledo, Ohio. "Security."
Campbell Electric Co., Lynn, Mass.
General Electric Co., Schenectady.
Hartford Time Switch Co., New York.
Manhattan Electrical Supply Co., New York. "Mesco".
McGill Mfg. Co., Valparaiso, Ind. "Crescent".
Reynolds Elec. Flasher Mfg. Co., Chicago, Ill.
Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
A. & W. Electric Sign Co., Cleveland, Ohio.
Abbott Mfg. Co., Cleveland, Ohio.
American Electric Sign Co., Boston, Mass.
Automatic Time Switch Co., Derby, Conn.
Baird Electric Co., Chicago, Ill.
Ballou-Hutchins Electric Co., Providence, R. I.

Betts & Betts, New York.
Central Burglar Alarm Co., Chicago, Ill. "Reliable".
Clark & Harvey, Dayton, Ohio. "Perfect".
Cleveland Dental Mfg. Co., Cleveland, Ohio. "Chappel".
Dixon, Paul, Atlanta, Ga.
Dorland & Co., Leslie C., Poughkeepsie, N. Y.
Link, G. H., Cincinnati, O.
Macalaster-Wiggin Co., Boston, Mass.
National Electric Time Switch Co., McKeesport, Pa.
Peerless Time Switch Co., Elkhart, Ind.
Rapp & Zallinger, South Bend, Ind.
Reliance Automatic Lighting Co., Warren, Ohio.
P. Sorensen, Brooklyn, N. Y.
South Bend Switch Clock Co., South Bend, Ind.
Standard Electric Time Switch Co., Sharon, Pa.
Taylor, Wm., New York. "Williams".
Waldman, John J., New York.

SWITCHES, Voltmeter.
Albert & J. M. Anderson Mfg. Co., Boston, Mass.
General Electric Co., Schenectady.
Mineralac Electric Co., Chicago.
J. Lang Electric Co., Chicago.
Walker Electric Co., Philadelphia, Pa.
Worcester Elect. & Mfg. Co., Worcester, Mass.

SYNCHRONIZERS, Recording.
Chemelectric Co., Chicago.

SYNCHROSCOPES. See Instruments, Testing.

SYRINGES. See Hydrometers.

TACHOMETERS AND TACHOGRAPHS. (Speed Indicators and Speed Recorders.)
Badt-Westburg Electric Co., Chicago.
Bristol Co., Waterbury, Conn.
Weston Electrical Instrument Co., Newark, N. J.
James G. Biddle, Philadelphia, Pa.
Electric Tachometer Co., Washington D. C. "Hopkins".
Esterline Co., Lafayette, Ind.
Industrial Instrument Co., Foxboro, Mass.
Keystone Electrical Instrument Co., Philadelphia, Pa.
Lombard Governor Co., Ashland, Mass.
Machado & Roller, New York. (Hartmann & Braun Tachometers.)
Queen-Gray Co., Philadelphia, Pa.
Reliance Electric & Engrg. Co., Cleveland, Ohio. (Speed Dials for Motors and Machinery.)
Veeder Mfg. Co., Hartford, Conn.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.
Warner Instrument Co., Beloit, Wis.

TAGS, Cable.
Harvard Electric Co., Chicago.
Ridlon Co., Frank, Boston, Mass.

TANK ALARMS.
W. R. Ostrander & Co. New York. "Nen".
Stanley & Patterson, New York. "Patterson".
Sundh Electric Co., New York.
W. F. Irish Electric Co., New York. "Shamrock".
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
John J. Waldman, New York.

TANK SWITCHES.
Electric Controller & Mfg. Co., Cleveland, O.
Sundh Elec. Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Automatic Switch Co., New York.
Chicago Pump Co., Chicago, Ill.
Electrical Repair Co., New York.
W. F. Irish Electric Co., New York. "Shamrock".
Jarvis Engine & Machine Works, Lansing, Mich.
Kewanee Water Supply Co., Kewanee, Ill.
Mesnier Mfg. Co., Baltimore, Md.
Sanitary Pump Co., Dayton, Ohio.
Twinvolute Pump & Mfg. Co. New York, N. Y.

TANKS, Oil Storage.
American Bridge Co., New York.

TANKS, Water.
American Bridge Co., New York.

TAPE, Insulating. (Splicing Gum, Friction Tape.)
American Electrical Works, Philipsdale, R. I. "Century".
Central Electric Co., Chicago, Ill.
Chicago Mica Co., Valparaiso, Ind.
Belden Mfg. Co., Chicago, Ill.
D & W Fuse Co. Providence, R. I. "Deltatape".
General Electric Co., Schenectady, N. Y. "Acme". "Paragon".
B. F. Goodrich Co., Akron, Ohio.
H. W. Johns-Manville Co., New York. "Magneto" "Fibroid" "Jomance", "J. M." "Niagrite".
Kerite Insulated Wire & Cable Co., New York.
Marion Insulated Wire & Rubber Co., Marion, Ind.
Mica Insulator Co., New York. "Linetape".
N. Y. Insulated Wire Co., New York. "Competition", "Grimshaw".
Packard Electric Co., Warren, Ohio. (Bias Cut.)
Okonite Co., New York. "Okonite", "Manson".
Standard Paint Co., New York. "P. & B."
Standard Underground Cable Co., Pittsburgh, Pa.
Western Electric Co., New York. "Victor", "Amazon".
Boston Woven Hose & Rubber Co., Cambridge, Mass. "Tiger", "Wizard", "B. W. H.", "Grip", "Brownie", "Bay State", "Magic".
Clifton Mfg. Co., Jamaica Plain, Boston, Mass. "Gilt Edge," "Viskus."
Dunton Co., M. W., Providence, R. I. "Black Diamond".
Goshen Rubber Works, Goshen, Ind.
Hartford Rubber Works Co., Hartford, Conn.
Hope Webbing Co., Providence, R. I. (Unsaturated Woven Tapes.)
Knowles, C. S., Boston, Mass. "Tenax", "Sampson".
Mass. Chemical Co., Walpole, Mass. "Dryfield", "Norfolk", "Walpole", "Gold Seal", "Maschemco", "Kachouk".
Mechanical Rubber Co., Cleveland, Ohio.
Morgan & Wright, Detroit, Mich.
National Insulator Co., Boston, Mass. "Nico".
Pennsylvania Rubber Co., Jeannette, Pa.
Philadelphia Elect. Mfg. Co., Philadelphia, Pa.
Revere Rubber Co., Boston, Mass. "V. Z."
Schoonmaker Co., A. O., New York. (Oiled Muslin.)
St. Louis Rubber Cement Co., St. Louis, Mo.
Tingue, Brown & Co., New York.
U. S. Asbestos Co., Manheim, Pa. "Usaco". (Asbestos.)

TAPING MACHINES. See Covering Machines.

TAPS, Current.
Benjamin Electric Mfg. Co., Chicago, Ill. "Wizard".
Jordan Bros., Inc., New York.
Manhattan Electrical Supply Co., New York. "Mesco".
Pass & Seymour, Inc., Solvay, N. Y.
The Dale Co., New York.
Harvey Hubbell, Inc., Bridgeport, Conn.
Meyrowitz Mfg. Co., New York. "Vetter".
Yonkers Specialty Co., Yonkers, N. Y. "Metropolitan."

TELAUTOGRAPHS.
Gray National Telautograph Co., Chicago, Ill.

TELEGRAPH INSTRUMENTS.
Manhattan Electrical Supply Co., New York. (Portable Outfit.)
Western Electric Co., New York.
Baltimore Machine Products Co., Baltimore, Md. "Viaduct".
Chas. Brandes, New York. (Navy Receivers.)
Brooklyn Wireless & Electric Novelty Co., Brooklyn, N. Y.
J. H. Bunnell & Co., New York.
Dawson & Winger Electric Co., Chicago, Ill.
Electrical Industries Mfg. Co., New York.
Electro Importing Co., New York. (Small Outfits.)
Farr Telephone & Construction Supply Co., Chicago. "D. & L."
Foote, Pierson & Co., New York.
Holtzer-Cabot Electric Co., Brookline, Mass. (Operator's Head Receivers.)
Manufacturers and Inventors Electric Co., New York. "Morse Watch".
Mecrograph Co., Cleveland, Ohio. (Transmitters.)
Omnigraph Mfg. Co., New York.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Queen-Gray Co., Philadelphia, Pa.
Roentgen Mfg. Co., Philadelphia.
United States Electric Co., New York. ("Gill" Selector.)
Voltamp Elec. Mfg. Co., Baltimore, Md.

TELEPHONES AND SWITCHBOARDS.
Automatic Electric Co., Chicago, Ill.
Central Electric Co., Chicago, Ill.
Kellogg Switchboard & Supply Co., Chicago, Ill. "Express".
Manhattan Electrical Supply Co., New York. "Mesco".
Menominee Electric Mfg. Co., Menominee, Mich.
Stanley & Patterson, New York.
Vote-Berger Co., La Crosse, Wis. "E. B. B.", "Pendent".
Western Electric Co., New York.
Ackerman-Boland Tel. Co., Chicago, Ill.
American Automatic Tel. Co., Urbana, Ohio.
American Electric Co., Chicago, Ill. "American Beauty", "Burns", "Leich", "Sampson", "Zabel".
American Tel. Co., Piqua, Ohio.
Andrae & Sons Co., J., Milwaukee, Wis.
Arnold Mfg. Co., S. G., Chicago, Ill.
Automatic Appliance Co., Boston, Mass.
B-R Elec. & Tel. Mfg. Co., Kansas City, Mo.
Baird Electric Co., Chicago, Ill. "Norstrom".
Baltimore Machine Products Co., Baltimore, Md.
Cadiz Electric Co., Cadiz, Ohio. "Crescent", "Mogul".
Central Tel. & Elec. Co., St. Louis, Mo. "Prime."
Century Tel. Construction Co., Buffalo, N. Y.
Chicago Telephone Supply Co., Elkhart, Ind.
Chicago Writing Machine Co., Galesburg, Ill.
Connecticut Telephone & Electric Co., Meriden, Conn.
Couch Co., S. H., Boston, Mass. "Multifone", "Modelfone".
Cracraft-Leich Elec. Co., Genoa, Ill.
Dean Electric Co., Elyria, Ohio.
DeVeau Telephone Mfg. Co., Brooklyn, N. Y.
Electric Goods Mfg. Co., Canton, Mass. "Annunciphone", "Bi-Une", "Roktokoil".
Electric Service Supplies Co., Philadelphia, Pa. ("Keystone" Railway.)
Electrical Engineering Co., Minneapolis, Minn.
Henry L. Elston, Muscoda, Wis.
Enochs Elec. Co., St. Paul, Minn.
Ericsson Mfg. Co., Buffalo, N. Y. (All Steel.)
Fisk Mfg. Co., H. M., Wheaton, Ill.
Gari Electric Co., Akron, Ohio.
Green Tel. & Elec. Mfg. Co., Milwaukee, Wis.
Hepburn Tel. Mfg. Co., Chicago.
Hogrebe & Co., E. C., Cincinnati, Ohio.
Holtzer-Cabot Electric Co., Brookline, Mass.
Independent Tel. Mfg. Co., Madison, Wis.
Inland Electric Co., St. Louis.
Interstate Elec. & Mfg. Co., Sioux City, Ia.
Johnson Mfg. Co., Philadelphia.
Kokomo Tel. & Elec. Mfg. Co., Kokomo, Ind.
Kusel Tel. & Elec. Mfg. Co., D. A., St. Louis, Mo.
Lafayette Electric & Mfg. Co., Lafayette, Ind.
Loeffler, Louis J., New York.
Long Distance Tel. Mfg. Co., South Bend, Ind.
Modern Electric Co., Burlington, Iowa. "Burlington".
Monarch Tel. Mfg. Co., Chicago.
National Elec. Works, Whittier, Cal. "Incitophone".
The National Dictograph Co., Jamaica, N. Y. (Dictograph.)
National Telegraphone Co., Rochester, N. Y. ("Telegraphone" for Telegraph Wires.)
North Electric Co., Cleveland, Ohio. ("Clement" Automanual.)
Novelty Electric Co., Philadelphia, Pa.
Partrick, Carter & Wilkins Co., Philadelphia, Pa.
Premier Electric Co., Chicago, Ill.
Regal Tel. & Mfg. Co., Saginaw, Mich.
Reliance Tel. & Mfg. Co., Butler, Pa.
Richmond Co., Oshkosh, Wis.
Homer Roberts Tel. Co., Chicago.
Russell Electric Co., Danbury, Conn.
Signalphone Alarm Co., Milwaukee, Wis.
Simplex Interior Tel. Co., Cincinnati, Ohio.
Simplex Telephone & Equipment Co., Pittsburgh, Pa. (Pocket.)
Sioux City Brass Works, Sioux City, Iowa.
Spencer Electrical Co., New York.
Standard Mfg. Co., Bridgeport, Conn. "Crown".
Standard Tel. Mfg. Co., Portsmouth, Ohio.
Stoddard Tel. Construction Co., Monroe, Mich.
Stromberg - Carlson Telephone Mfg. Co., Rochester, N. Y.
Swedish-American Telephone Co., Chicago.
Utica Fire Alarm Teleg. Co., Utica, N. Y.
Vulcan Mfg. Co., Chicago, Ill. (Intercommunicating.) "Me-Wade".
Western Tel. Mfg. Co., Chicago, Ill. "Ideal", "Economist".
Wilhelm Tel. Mfg. Co., Buffalo.
Williams Tel. & Supply Co., Cleveland, Ohio.

TELEPHONE ATTACHMENTS.
Electric Goods Mfg. Co., Canton, Mass. "Dupliphone".

TELEPHONES, Automatic.
American Automatic Telephone Co., Urbana, O.
Automatic Electric Co., Chicago.

TELEPHONE DESK ARMS. See Brackets.

TEMPERATURE REGULATORS. See Regulators.

TERMINALS, Automobile, Primary, Secondary.
Chicago Electric Mfg. Co., Chicago.
Frank B. Cook, Chicago.
Frank W. Morse, Boston, Mass.

TERMINALS, Fuse. See Fuses.

TERMINALS, Telephone Cable. See also Potheads.
Bissell Co., F., Toledo, Ohio. "Security".
Fairmount Electric & Mfg. Co., Philadelphia, Pa.
Standard Underground Cable Co., Pittsburgh, Pa. "Davis".
Western Electric Co., New York.
Central Tel. & Elec. Co., St. Louis, Mo.
Frank B. Cook, Chicago.
Harvard Electric Co., Chicago.
La Fayette Elec. & Mfg. Co., La Fayette, Ind.
Moon Mfg. Co., Chicago, Ill.
Southern Ind. Electric Co., New Albany, Ind.

TERMINALS, Underground Service.
Dossert & Co., New York.
Philadelphia Electrical & Mfg. Co., Philadelphia, Pa.

TERMINALS, Wire. See Connectors, Battery, also see Lugs.

TEST CLAMPS AND CONNECTORS.
Appleton Electric Co., Chicago, Ill.
Belden Mfg. Co., Chicago, Ill.
Fairmount Electric & Mfg. Co., Philadelphia, Pa. "H. H. W."
Hubbard & Co., Pittsburgh, Pa.
Aurora Cable Clip Co., Aurora, Ill.
Chicago Electric Mfg. Co., Chicago.
Chicago Nut Co., Chicago.
Scott C. Cutter, Oswego, Ill.
Fahnestock Elec. Co., Brooklyn.
Frankel Display Fixture Co., New York.
Hallett Iron Works, Chicago, Ill.
Harvard Electric Co., Chicago, Ill.
B. F. Kierulff, Jr., & Co., Los Angeles, Calif. "Wardman".
Milwaukee Electrical Specialties Co., Milwaukee, Wis.
Frank W. Morse, Boston, Mass. "Eureka."
R. S. Mueller & Co., Cleveland, Ohio. ("Universal" Insulated.)
Nagel-Chase Mfg. Co., Chicago, Ill. "N. C."
P. & M. Co., Chicago, Ill.
Williams Test Clamp Co., Cleveland, Ohio.
Yonkers Specialty Co., Yonkers, N. Y. "Metropolitan".

TESTERS, Fuse.
James H. Carry, Portland, Me.
Electric Specialty Co., Cresco, Iowa. "Addie".

TESTING INSTRUMENTS. See Instruments, Testing.

TESTING LABORATORIES.
Electrical Testing Laboratories, New York, N. Y.
Electrical Testing Co., Peoria, Ill.
National Electrical Laboratories, New York, N. Y.
Philadelphia Meter Improvement Co., Philadelphia, Pa.

THEATRE DIMMERS. See Rheostats, Stage Dimming.

THERMOMETERS, Electric.
Bristol Company, Waterbury, Conn.
Leeds & Northrup Co., Philadelphia, Pa.
Keystone Electrical Instrument Co., Philadelphia, Pa.
Queen-Gray Co., Philadelphia, Pa.

THERMOSTATIC ALARMS. See Fire Alarms.

THERMOSTATS.
Bristol Co., Waterbury, Conn.
Manhattan Electrical Supply Co. New York, N. Y.
Anderson Co., Thos. P., New York, N. Y.

Bunnell & Co., J. H., New York.
Copenhagen Automatic Fire Alarm Co., Sheboygan, Wis.
Electrical Automatic Appliance Co., Denver, Colo.
Milwaukee Automatic Fire Service Co., Milwaukee, Wis.
Montauk Fire Detecting Wire Co., New York, N. Y. "Quickest".
Murphy Specialty Co., Detroit, Mich.
National Clock & Electric Mfg. Co., St. Louis, Mo.
Star Electric Co., Binghamton, N. Y.
Storms, Francis, New York. (Mercurial.)
Vierkant, H. C., Tarrytown, New York.
Wall, G. A., Providence, R. I.

THREAD, Insulating. See Yarn.

TIE WIRE, Formers. See Formers.

TIES, Pressed Steel.
American Bridge Co., New York.

TIME STAMPS.
Calculagraph Co., New York.
Baird Electric Co., Chicago.
Ellis Time Stamp Co., Chicago.
Industrial Instrument Co., Foxboro, Mass.
Sohm Electric Signal and Recording Co., Chicago.

TIME SWITCHES. See Switches, Time.

TIMERS, Ignition.
Beckley-Ralston Co., Chicago, Ill. "Maximus".
Benford Mfg. Co., E. M., Mt. Vernon, N. Y. "Monarch".
Duplex Coil Co., Fond du Lac, Wis.
Fulmer, C. F., Plainfield, N. J. "Invincible".
Heinze Electric Co., Lowell, Mass.
Herbert, W. H., Chicago, Ill. "Little Giant".
Kokomo Electric Co., Kokomo, Ind. "Kingston".
Lovell-McConnell Co., Newark, N. J. "Lacoste".
Uncas Specialty Co., Norwich, Conn. "Leavitt".
Waterhouse Co., Boston, Mass. "Bemis".
Witherbee Igniter Co., Springfield, Mass. "Wico".

TIPS, Cord.
Belden Mfg. Co., Chicago, Ill.
Rome Wire Co., Rome, N. Y.
McEvoy, C. H., Lowell, Mass. "Duro".
National Acme Mfg. Co., Cleveland, Ohio.
Runsel-Lenz Elec. Mfg. Co., Chicago.

TOGGLE-BOLTS.
Geo. Cutter Co., South Bend, Ind. "Lever".
McGill Mfg. Co., Valparaiso, Ind. "Crescent".
Chicago Nut Co., Chicago, Ill. "Ajax".
Conlan Electric Co., New York. ("Jenceco" Toggle Strap.)
P. Sorenson, Brooklyn, N. Y.
Star Expansion Bolt Co., New York.
Steward & Romaine Mfg. Co., Philadelphia, Pa.
John J. Waldman, New York, N. Y.
Thos. Wrigley Co., Chicago, Ill.

TOLL BOXES. See Meters.

TONGS, Carbon.
Billings & Spencer Co., Hartford, Conn.

TONGS, Fuse Plug.
Conrad, J. D., Columbus, Ohio.

TOOL BAGS. See Tools, Linemen's.

TOOLS, Boring, Electricians'.
Electric Appliance Co., Chicago, Ill. "O. K."
P R Mfg. Co., Detroit, Mich. "Anthony."
Bergman Tool Mfg. Co., Buffalo, N. Y. "Amiden".
Bowlus Mfg. Co., H. C., Springfield, Ohio.
Busch Mfg. Co., San Francisco, Calif. "Standard".
Chicago Pneumatic Tool Co., Chicago, Ill. "Duntley", "Little Giant".
Cincinnati Tool Co., Cincinnati, O.
Daugherty, Smith, Phillips Co., Chicago.
Ford Auger Bit Co., Holyoke, Mass. "Standard".
Fray & Co., J. S., Bridgeport, Conn.
Garretson, George, San Diego, Calif. "K. & G."
Henderson Electric Co. Charlottesville, Va.
Jones Convertible Boring Machine Co., Pittsburgh, Pa.
Kyle, W. H., Akron, Ohio.
McCrea & Co. Jas., Chicago, Ill. "Zeek", "Roberts".
Mayhew Co., H. H., Shelburne Falls, Mass. "Goodell".
Millers Falls Co., New York.
North Bros. Mfg. Co., Philadelphia, Pa. "Yankee".
Powell, H. S., Utica, N. Y. (Linemen's Pole Brace.)
Rover, A. B., Binghamton, N. Y. "G. & E."
J. H. Rusby, Newark, N. J.
Russell Jennings Mfg. Co., Chester, Conn.
Shellman, A. J., Grand Rapids, Mich. "Signor".

TOOLS, Cable Pulling.
American Steel & Wire Co., Chicago, Ill.
General Electric Co., Schenectady.
B. F. Goodrich Co., Akron, Ohio.
Hazard Mfg. Co., Wilkes-Barre.
Hubbard & Co., Pittsburgh, Pa.
Packard Electric Co., Warren, Ohio.
Roebling's Sons Co., John A., Trenton, N. J.
Safety Insulated Wire & Cable Co., New York.
Bishop Gutta Percha Co., New York.
Boston Insulated Wire & Cable Co., Boston, Mass.
T. J. Cope, Philadelphia, Pa.
Hallett Iron Works, Chicago, Ill.

TOOLS, Commutator Truing.
Fort Wayne Electric Works, Ft. Wayne, Ind. "B. & B."
General Electric Co., Schenectady.
Jordan Bros., New York.
Bryant & Berry Co., Detroit, Mich.
Imperial Electric Co., Akron, Ohio. "Carr".
Phillips Mfg. Co., New York.
Railway & Industrial Engineering Co., Pittsburgh, Pa. "Burke".

TOOLS, Digging, Augers, Spoons.
Hubbard & Co., Pittsburgh, Pa.
Mathias Klein & Sons, Chicago.
Oshkosh Mfg. Co., Oshkosh, Wis.
Ames Shovel & Tool Co., N. Easton, Mass.
Beall Bros., Alton, Ill.
H. Channon Co., Chicago, Ill.
Columbus Handle & Tool Co., Columbus, Ind.
Eureka Digging Co., Chicago.
Everstick Anchor Co., St. Louis, Mo. ("Blackburne" Telescoping Auger Handles.)
Fairbanks, Morse & Co., Chicago.
Gibbs Mfg. Co., Canton, Ohio "National", "Columbus".
Iwan Bros., South Bend, Ind. (Post Hole Augers.)
Pittsburgh Shovel Co., Pittsburgh.
Standard Earth Auger Co., Chicago, Ill.
Wyoming Shovel Works, Wyoming, Pa.

TOOLS, LINEMEN'S. See also Climbers, Pliers, Drills, Splicing Clamps.
Central Electric Co., Chicago, Ill.
Hubbard & Co., Pittsburgh, Pa.
Mathias Klein & Sons, Chicago.
W. N. Matthews & Bro., St. Louis, Mo.
Oshkosh Mfg. Co., Oshkosh, Wis.
Smith & Hemenway Co., New York.
Sprague Electric Works, New York. (Conduit Cutting and Reaming.)
Berry Bros., Detroit, Mich.
Buckeye Mfg. Co., Canton, Ohio ("Electric" Spud.)
Champion Tool & Handle Works, Evart, Mich. (Pike Poles.)
Columbus Handle & Tool Co., Columbus, Ind.
Dicke Tool Co., Downers Grove, Ill.
Electric Tool Co., Chicago. "P & G" Wire Skinner.
Hallett Iron Works, Chicago, Ill.
Handlan-Buck Mfg. Co., St. Louis, Mo. "Jackson".
Fred L. Meekel, Chicago, Ill.
C. S. Osborne & Co., Newark, N. J.
Safety Armorite Conduit Co., Pittsburgh, Pa. (Armor Strippers.)
Vanderman Mfg. Co., Willimantic, Conn. (Tool Boxes and Pipe Benders.)

TOOLS, Pipe Fitting.
Borden Co., Warren, O. "Beaver" Die Stocks.

TOOLS, Portable Electric Polishers, Buffers, Drills, Grinders, Hammers.
Emerson Electric Mfg. Co., St. Louis, Mo.
Fort Wayne Electric Works, Fort Wayne, Ind.
General Electric Co., Schenectady, N. Y. (Portable Breast Drill.)
Hamilton-Beach Mfg. Co., Racine, Wis. "H-B Portable".
Mechanical Appliance Co., Milwaukee, Wis. (Ajax Riveters, "Watson" Buffers and Grinders.)
Morse Twist Drill & Machine Co., New Bedford, Mass.
Robbins & Myers Co., Springfield, Ohio.
Sprague Electric Co., New York.
Western Electric Co., New York. ("Hawthorn" Breast Drill.)
Anderson Elec. Mach. Tool Co., St. Louis, Mo.
Bodine Elec. Co., Chicago, Ill.
Caldwell & Co., J. E., Philadelphia, Pa. (Silver Cleaners.)
Chicago Pneumatic Tool Co., Chicago, Ill. ("Duntley" and "Little Giant" Drills.)
Cincinnati Electrical Tool Co., Cincinnati, O. "Peerless".
Jas. Clarke, Jr., Elec. Co., Louisville, Ky.
Coates Clipper Mfg. Co., Worcester, Mass.
Thos. H. Dallett Co., Philadelphia, Pa.
Deer Co., Inc., A. J., Hornell, N. Y. ("Royal" Portable Drills.)
Dilg Mfg. & Trading Co., New York.
Electro-Magnetic Tool Co., Chicago, Ill. (Electric Percussion Drill for Stone, Brick and Concrete, also Hammers.)
Fortuna Machine Co., New York. (Importers Drills.)
Foster & Hosier, Chicago, Ill. ("Ajax" Tool for Lettering on Stone.)
Globe Electric Co., Chicago, Ill. (Buffing Lathes.)
Goshen Stamping & Brass Co., Goshen, Ind.
W. Green Electric Co., New York.
Hisey-Wolfe Machine Co., Cincinnati, O.
Holtzer-Cabot Electric Co., Brookline, Mass.
Kelley Electric Machine Co., Buffalo, N. Y.
Lamb Elec. Co., Grand Rapids, Mich.
Leiman Bros., New York. (Combination Polishing and Dust Collecting Outfit.)
Oliver Mfg. Co., W. W., Buffalo, N. Y.
Pennsylvania Casting & Machine Co., Pittsburgh, Pa.
Roth Bros. & Co., Chicago, Ill.
Standard Elect. Tool Co., Cincinnati, O.
Stewart, S. J., New Orleans, La. ("Standard" Polishing Lathe.)
Stow Mfg. Co., Binghamton, N. Y. (Buffers and Polishers.)
U. S. Electric Tool Co., Cincinnati, O.
Victor Electric Co., Chicago, Ill.
Virginia Electric Tool & Mfg. Co., Petersburg, Va. ("Paulero" Electric Hammer.)
Wiley Auto & Mach. Co., Jeffersonville, Ind. "Simple".

TOOLS, Threading.
Borden Co., Warren, Ohio.

TORCHES, Alcohol.
McGill Mfg. Co., Valparaiso, Ind.
Berns, Otto, Newark, N. J. "Always Reliable".
Clayton & Lambert Mfg. Co., Detroit, Mich.
Hess & Son, Philadelphia, Pa. "Tinol".
Knapp Mfg. Co., New York. (Self-Acting.)
Osborne & Co., C. S., Newark, N. J.
Turner Brass Works, Sycamore, Ill. "Gem", "Wilson".
H. C. Roberts Elec. Supply Co., Philadelphia, Pa. "Victor". "Roberts".
Wood, Jr., C. D., New York. "Liberty".

TORCHES AND FURNACES, Gasoline.
Bridgeport Brass Co., Bridgeport Conn. ("Queen", "Vulcan" Torches.)
McGill Mfg. Co., Valparaiso, Ind.
A. D. Mfg. Co., Detroit, Mich.
American Stove Co., St. Louis, Mo. ("Reliable" Furnace.)
Ashton Mfg. Co., Newark, N. J. "Red Hot".
Baker & Sons Co., J. R., Kendallville, Ind. (Furnaces.)
Berns, Otto, Newark, N. J. ("Always Reliable" Furnace.)
Burgess Soldering Furnace Co., Columbus, O. ("Gem" Furnace.)
Carleton Co., Boston, Mass. "Imp."
Clayton & Lambert Mfg. Co., Detroit, Mich.
Diener Mfg. Co., G. W., Chicago, Ill. "Torrid".
Globe Brass Works, Detroit, Mich. ("Diamond", "Perfection" Torches.)
Haines, Jones & Cadbury Co., Philadelphia, Pa. (Furnaces.)
Hine-Watt Mfg. Co., Chicago, Ill. ("Marion" Torch.)
Knapp Mfg. Co., New York.
Park & McKay Co., Detroit, Mich. (Furnaces.)
Quadriga Mfg. Co., Chicago, Ill. ("Walters" Torch.)
Register, Robt. A., Baltimore, Md. "Victor".
Sun Vapor Street Light Co., Canton, Ohio. (Torches.)
Turner Brass Works, Sycamore, Ill. "Kinzie", "Hot Blast", "Old Reliable", "Franklin", "Mogul, Jr.", "Jewell", "Bull Dog", "Mogul".
Volcano Torch & Mfg. Co., Erie, Pa. (Torches.)
Wall Mfg. Supply Co., Pittsburgh, Pa. "Dreadnaught."
The Wellington Mfg. Co., New York. (Torches.)
West Mfg. Co., Buffalo, N. Y. (Furnaces.)
Wolff Mfg. Co., L., Chicago, Ill. ("Duro" Furnace.)

TORCHES AND FURNACES, Kerosene.
Barnes Tool Co., New Haven, Conn. (Furnaces.)
Barthel Blow-Lamp Co., Boston, Mass. (Torches.)
McClintock & Irvine, Pittsburgh.
Mack Mfg. Co., T. A., Jersey City, N. J. ("Khotal" Furnace.)
Turner Brass Works, Sycamore, Ill. "Hot Blast".

TOWER WAGONS. See Wagons.

TOWERS, Cooling. See Cooling.

TOWERS, Electric Transmission.
American Bridge Co., New York.

TOWERS, Steel, Transmission.
American Bridge Co., New York.
Aermotor Co., Chicago, Ill.
Archbold-Brady Co., Syracuse, N. Y.
Fitzpatrick & Coombs, New York, N. Y.
Los Angeles Switch & Signal Co., Los Angeles, Cal.
Milliken Bros., New York.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Ross Supply Co., Greenville, Ohio.

TOY MOTORS. See Motors, Battery.

TOY TRANSFORMERS. See Transformers, Low Voltage.

TOYS AND NOVELTIES.
Manhattan Electrical Supply Co., New York, "Mesco".
Stanley & Patterson, New York. ("Matchless" Scarfpin.)
Carlisle & Finch Co., Cincinnati, Ohio.
Electro Importing Co., New York.
Franco-American Electric Novelty Co., New York.
H. K. Electric Toy Co., Indianapolis, Ind. (Toy Engine.)
Howard Miniature Lamp Co., Newark, N. J.
Industrial Novelty Co., Chicago, Ill.
Ives Mfg. Corp., Bridgeport, Conn.
Kendrick & Davis Co., Lebanon, N. H.
Knapp Elec. & Novelty Co., New York. ("Electric Questioner" and Street Railway.)
Lionel Mfg. Co., New York. ("De-Luxe" Train.)
Ohio Electric Works, Cleveland.
Leon W. Pullen Co., Philadelphia, Pa.
Rhode Island Telephone & Electric Co., Providence, R. I. (Baby Dynamos.)
Russell Elec. Co., Danbury, Conn "Mimiphone".
Standard Electric Novelty Co., Chicago, Ill.
Swedish-American Telephone Co., Chicago, Ill. (Solenoid Electric Engines.)
E. J. Tardie, New York.
Universal Novelty Co., New York. (Magic Lantern.)
Voltamp Electric Mfg. Co., Baltimore, Md.
Alfred Wolff & Co., New York.

TRANSFORMER CUT-OUTS. See Cut-Outs.

TRANSFORMERS, Constant Potential. (Tub Systems.)
Fort Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady.
Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.
Helios Mfg. Co., Philadelphia, Pa.

TRANSFORMERS, High Voltage.

Allis - Chalmers Manufacturing Co., Milwaukee, Wis.
Campbell Electric Co., Lynn, Mass.
Central Electric Co., Chicago, Ill.
Crocker-Wheeler Co., Ampere, N. J. "Remek".
Duncan Electric Mfg. Co., Lafayette, Ind.
Fort Wayne Elec. Works, Fort Wayne, Ind.
General Electric Co., Schenectady.
Kuhlman Electric Co., Elkhart, Ind.
Packard Electric Co., Warren, O.
Pittsburgh Transformer Co., Pittsburgh, Pa.
Triumph Electric Co., Cincinnati, Ohio.
Wagner Electric Mfg. Co., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
American Transformer Co., Newark, N. J.
Enterprise Electric Co., Warren, O. "Peerless".
Esterline Co., Lafayette, Ind. (High Tension Testing Transformers.)
James Jones Co., Los Angeles, Calif. "Omega".
Moloney Electric Co., St. Louis, Mo.
Vindex Electric Co., Aurora, Ill.

TRANSFORMERS, Low Voltage, Moving Picture, Tungsten Economizing, Wireless, Toy, Bell Ringing.

Campbell Elec. Co., Lynn, Mass. ("Lowvolt" for Tungsten Lamps.)
Central Electric Co., Chicago, Ill.
Crocker-Wheeler Co., Ampere, N. J. "Remek."
Ft. Wayne Elec. Works, Ft. Wayne, Ind.. "Wayne."
General Electric Co., Schenectady.
Kuhlman Electric Co., Elkhart, Ind.
Manhattan Electrical Supply Co., New York, N. Y. (A. C.)
Moloney Electric Co., St. Louis, Mo.
Packard Electric Co,. Warren, O.
Pittsburgh Transformer Co., Pittsburgh, Pa.
Reynolds Electric Flasher Mfg. Co., Chicago, Ill.
Sangamo Electric Co., Springfield, Ill.
Triumph Electric Co., Cincinnati, Ohio.
Viking Elec. Co., Albany, N. Y. (Bell Ringing.)
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
American Transformer Co., Newark, N. J.
Bell & Howell Co., Chicago, Ill.
Bennett Co., I. A., Chicago, Ill. "No-Watt."
Butler Electric Co., David City, Nebr.
Connecticut Tel. & Elec. Co., Meriden, Conn.
Dongan Electric Mfg. Co., Detroit, Mich.
Dynalectric Co., Hyde Park, Mass.
Edwards & Co., New York. "Cadet," "Dixie."
Electric Economy Co., Roxbury, Boston, Mass. "Beacon."
Electro-Surgical Inst. Co., Rochester, N. Y. (For Surgical Miniature Lamps.)
Enterprise Electric Co., Warren, O. "Peerless."
Goettmann, O. J., Pittsburgh, Pa.
Hadfield-Hall Co., Wausau, Wis. ("H. & H." for Moving Pictures.)
Hallberg, J. H., New York, N. Y. (For Moving Pictures, Tungsten Lamps.)
R. Haas Elec. & Mfg. Co., Springfield, Ill. **"Adams."**
Hartman Electrical Mfg. Co., Mansfield, O. (Bell ringing.)
Hoskins Mfg. Co., Detroit, Mich. (Used in connection with Ammeters and Voltmeters.)
Mohawk Electric Co., Newark, N. J.
Reppel Electric Co., Kansas City, Mo. (Bell Ringing.)
Thordarson Electric Mfg. Co., Chicago, Ill.
Vindex Elec. Co., Aurora, Ill.
Warner Arc Lamp Co., Wilton Junction, Iowa.
Western Transformer Co., East Oakland, Cal.

TRANSMISSION MATERIAL.

General Electric Co., Schenectady.
H. W. Johns-Manville Co., New York, N. Y.

TREADS, Floor, Push Button.

Manhattan Electrical Supply Co., New York, N. Y.
Ansonia Electrical Co., Ansonia, Conn. "Delay."
Edwards & Co., New York, N. Y. "Dixie."
Keil & Son, Francis, New York, N. Y.
Renim Specialty Co., Brighton Station, Boston, Mass. "Ideal."

TREE INSULATORS.

Albert & J. M. Anderson Mfg. Co., Boston, Mass.
Geo. Cutter Co., South Bend, Ind.
High Tension Electrical Specialty Co., Newton, Mass. "Holmes."
Line Material Works, South Milwaukee, Wis.
Brookfield Glass Co., New York.
Scott C. Cutter, Oswego, Ill.
Dickinson Mfg. Co., Springfield, Mass.
Dunton & Field, Cambridge, Mass.
Marlatt, S., Richmond, Ind. "Peerless."
McKenney & Waterbury Co., Boston, Mass. "Harrigan."
Ohio Brass Co., Mansfield, Ohio.
W. H. Olmstead Mfg. Co., Detroit, Mich. ("Buckbee" Rotary Tree Bracket.)
Wetmore-Savage Co., Boston, Mass. (Sole Selling Agents for "Kirby.")

TREE TRIMMERS.

Boyd Mfg. Co., Rockville, Ind.

TROLLEYS AND CHAIRS, (Cable Stringing).

F. Bissell Co., Toledo, Ohio. "Security."
W. N. Matthews & Bro., St. Louis, Mo.
Oshkosh Mfg. Co., Oshkosh, Wis.
Central Telephone & Elec. Co., St. Louis, Mo. "Arrow."

TROUBLE FINDING LAMPS.

See Guards, Portable.

TRUCKS, ARMATURE.

See Machines.

TRUCKS, Electric.

See Automobiles.

TRUSSES, Roof.

American Bridge Co., New York.

TUBE BENDERS.

See Benders.

TUBE CLEANERS, Boiler Flue.

See Cleaners.

TUBE CUTTERS.

See Pipe Fitting Tools.

TUBES, Paper.

See Sleeves, Paper.

TUBES, Porcelain.

See Porcelain.

TUBES, Speaking.

Central Electric Co., Chicago, Ill.
Manhattan Electrical Supply Co., New York, N. Y.
Ostrander Co., W. R., New York, N. Y.
Western Electric Co., New York.
Francis Keil & Son, New York.
Poole, James W., Boston, Mass.
Vulcan Mfg. Co., Chicago, Ill. (Phone and Mail Box.) "McWade" Combination Tube.
Owen Walsh Mfg. Co., New York, N. Y.
Wilhelm, H., Brooklyn, N. Y.

TUBING, Brass and Copper.

Bridgeport Brass Co., Bridgeport, Conn.
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Coe Brass Mfg. Co., Torrington, Conn.
French Mfg. Co., Waterbury, Conn.
O. T. Hungerford Brass & Copper Co., New York, N. Y.
Elwood Ivins, Philadelphia, Pa.
C. S. Knowles, Boston, Mass.
National Brass & Copper Tube Co., New York, N. Y.
New Jersey Tube Co., Harrison, N. J.
Randolph-Clowes Co., Waterbury, Conn.
Rome Brass & Copper Co., Rome, N. Y.
Summerill Tubing Co., Philadelphia, Pa.
United Wire & Supply Co., Providence, R. I.
Wells & Co., A. H., Waterbury, Conn.

TUBING, Flexible Fabric.

(See also Conduit, Flexible.)
Atlantic Tubing Co., Providence, R. I.
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Crescent Belting & Packing Co., Trenton, N. J.
New York Belting & Packing Co., New York, N. Y.
New York Gas Tubing Co., New York, N. Y.

TUNGSTEN ADAPTERS.

See Adapters.

TUNGSTEN BOXES AND WRAPPERS.

See Boxes.

TUNGSTEN CLUSTERS.

See Clusters.

TURBINE GOVERNORS.

Allis - Chalmers Manufacturing Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

TURBINES, Steam.

Allis - Chalmers Manufacturing Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Machine Co., Pittsburgh, Pa. "Westinghouse-Parsons."
Ball & Wood Co., Elizabethport, N. J. "Rateau-Smoot."
E. W. Bliss Co., Brooklyn, N. Y.
DeLaval Steam Turbine Co., Trenton, N. J.
Hooven, Owens & Rentschler Co., Hamilton, O. "Hamilton-Holswarth."
Kerr Turbine Co., Wellsville, ... Y.
B. F. Sturtevant Co., Hyde Park, Mass.
Terry Steam Turbine Co., Hartford, Conn.
Wilkinson Turbine Co., Birmingham, Ala.

TURBINES, Water.

Allis - Chalmers Manufacturing Co., Milwaukee, Wis.
Allentown Foundry & Machine Co., Allentown, Pa.
American Steel Dredge Works, Logansport, Ind. "Little Giant."
Baugher, Kurtz & Stewart, York, Pa. "Rechard."
Camden Water Wheel Works, Camden, N. Y.
Cassel Automatic Water Motor Co., Seattle, Wash.
Chase Turbine Mfg. Co., Orange, Mass.
Christiana Machine Co., Christiana, Pa.
Dayton Globe Iron Works, Dayton, O. "New American."
Abner Doble Co., San Francisco, Calif.
Humphrey Machine Co., Keene, N. H.
Rodney Hunt Machine Co., Orange, Mass.
Leffel & Co., James, Springfield, O. "Samson."
Norrish, Burnham & Co., Glen Rock, Pa. "Burnham."
Pelton Water Wheel Co., San Francisco, Calif. "Pelton-Francis."
Platt Iron Works Co., Dayton, O. "Victor."
Risdon-Aicott Turbine Co., Mt Holly, N. J. "Leviathan."
Robinson, A. J., Brentwood, N. H.
Smith Co., S. Morgan, York, Pa. "McCormick."
Steele Water Motor Co., Moravia, N. Y. "Helical."
Trump Mfg. Co., Springfield, O.
Turners Falls Machine Co., Turners Falls, Mass. "Crocker."
United Iron Works, Oakland, Calif. "Tuthill."
Wolf Co., Chambersburg, Pa.

UNDERGROUND INSTALLATIONS.

Gest, G. M., New York, N. Y.
Graner-Mahoney Contracting Co., St. Louis, Mo.
Standard Underground Cable Co., Pittsburgh, Pa.
J. W. Turner Improvement Co., Des Moines, Iowa.

UNITS.

See Resistance.

VACUUM CLEANERS.

Central Electric Co., Chicago, Ill.
Federal Sign System (Electric), Chicago, Ill. "Federal."
American Radiator Co., Chicago, Ill. "Houston."
American Rotary Valve Co., Chicago, Ill. (Plant.)
American Suction Cleaner Co., New York, "Peerless."
H. J. Astle & Co., Providence, R. I. "Borland."
Atwood Vacuum Cleaner Co., Rockford, Ill.
Automatic Vacuum Cleaner Co., Bloomington, Ill.
Backus Co., Newark, N. J.
Roy C. Baker, Boston, Mass. (Cleaning Plant.)
Birtman Electric Co., Chicago, Ill. "Bee."
Clements Mfg. Co., Chicago, Ill. "Cadillac."
Connersville Blower Co., Connersville, Ind.
Cyclone Vacuum Cleaner Co., Bradford, Pa. "Champion," "Superb."
Duntley Mfg. Co., Chicago, Ill. "Standard."
Electric Cleaner Co., Chicago, Ill. "Reliable," "Positive."
Electric Renovator Mfg. Co., Pittsburgh, Pa. "Invincible."
Empire Vacuum Co., New York, N. Y. "Imperial."
Eureka Vacuum Cleaner Co., Detroit, Mich.
Everson Mfg. Co., Boston, Mass.
Foster & Glidden Eng'g Co., Buffalo, N. Y.
General Compressed Air and Vacuum Machinery Co., St. Louis, Mo. "Thurman."
Hanlon & Wilson, Wilkinsburg, Pa. "Vak-Klean."
Hope Vacuum Cleaner Co., Kansas City, Mo. (Stationary.)
Hoover Suction Sweeper Co., New Berlin, O.
Keller Mfg. Co., Philadelphia, Pa. "Santo."
Koch & Nichols, Ann Arbor, Mich. "Ajax" Stationary.
J. Livingston & Co., New York, N. Y.
McCrum-Howell Co., New York, N. Y.
Mercantile Supply Co., Cleveland, Ohio. "Eclipse."
Milwaukee Vacuum Machinery Co., Milwaukee, Wis.
Monarch Vacuum Cleaner Co., New York.
National Vacuum Cleaner & Mfg. Co, Litchfield, Ill.
New York Vacuum Cleaner Co., Rahway, N. J.
Nohe Electric Renovator Co., Chicago, Ill. "Nuway."
Pacific Suction Cleaner Co., San Francisco, Calif. "Little Giant."
Palm Engineering Co., Detroit.
Perfection Vacuum Cleaner Co., Chicago, Ill.
Pnuevac Co., Boston, Mass.
Premier Vacuum Cleaner Co., Cleveland, Ohio.
Quam Pneumatic Cleaner Co., Waterloo, Iowa.
Regina Co., New York, N. Y.
Robertson Mfg. Co., Cincinnati.
Rosenfield Mfg. Co., New York, N. Y. "Magic."
C. B. Rumsey Engine & Machine Co., Friendship, N. Y.
Sanitary Vacuum Cleaner Co., Medford, Mass.
Shedd Electric Co., Roselle Park, N. J.
Spencer Turbine Cleaner Co., Hartford, Conn.
B. F. Sturtevant Co., Hyde Park, Mass.
Taber Pump Co., Buffalo, N. Y.
United Electric Co., Canton, O. "Turc." (Stationary.)
United States Vacuum Cleaner Co., Bradford, Pa. "New Maid."
United Vacuum Appliance Co., New York, N. Y.
Vacuum Engineering Co., New York, N. Y. ("Rotrex" Stationary.)
Vacuna Co., New York, N. Y.
Victor Cleaner Co., York, Pa.
Vortex Vacuum Co., Watertown, N. Y.
Winans Machine Co., Binghamton, N. Y.
Zimmer Vacuum Renovator Co., Minneapolis, Minn.

VACUUM DRIERS.

See Driers.

VALVES, Safety.

American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Crosby Steam Gauge & Valve Co., Boston, Mass.

VALVES, Steam and Water. (Electrically Operated.)

Cutler-Hammer Mfg. Co., Milwaukee, Wis. (Solenoid.)
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., Boston, Mass.
Coldwell-Wilcox Co., Newburgh, N. Y. (Sluice Gates.)
Collins, G. W., Bridgeport, Conn.
Crane Co., Chicago, Ill.
Nelson Valve Co., Philadelphia, Pa.
Pittsburgh Valve, Foundry and Construction Co., Pittsburgh, Pa.
Pratt & Cady Co., Hartford, Conn.

Schutte & Koerting Co., Philadelphia, Pa.

VARNISH, Insulating.
Chicago Mica Co., Valparaiso, Ind. "Crystal."
General Electric Co., Schenectady, N. Y.
Mineralac Electric Co., Chicago, Ill.
Packard Electric Co., Warren, O.
Sherwin-Williams Co., Cleveland, O. "Ajax."
Standard Paint Co., New York.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Benolite Co., Pittsburgh, Pa.
Calman & Co., E., New York, N. Y. "Ohmlac."
Central Paint & Supply Co., St. Louis, Mo. "Gilselgloss."
Devoe & C. T. Raynolds Co., F. W., New York, N. Y.
Dielectric Mfg. Co., St. Louis, Mo. "Potrote."
Dolph Co., John C., Newark, N. J. "Vaculite," "Wayahead," "Jayseedee."
Eagle Paint & Varnish Co., Pittsburgh, Pa.
Massachusetts Chemical Co., Walpole, Mass. "Insullac", "Armalac".
McLee Electric & Mfg. Co., Brooklyn, N. Y. (Impregnating Compound.)
Moller & Schumann Co., Brooklyn, N. Y.
Schenectady Varnish Co., Schenectady, N. Y.
Standard Varnish Co., New York, N. Y. "Impregnite," "G. P.," "Voltalac."
Sterling Varnish Co., Pittsburgh, Pa. "Motorlac."

VEGETABLE PEELERS.
See Peelers.

VEHICLES, Electric.
See Automobiles.

VENTILATING FANS.
See Blowers.
(For small sizes, see Fans.)

VIBRATORS, Massage.
Hamilton-Beach Mfg. Co., Racine, Wis. "New Life".
Manhattan Electrical Supply Co., New York, N. Y. "Premier," ("Gem" Battery Type), "Morrison," "Reliance."
Sanax Co., Inc., New York. "Sanax."
Allison Co., W. D., Indianapolis, Ind. "Bihlmaier."
Baker Electric Co., Hartford, Conn.
Barker, James, Philadelphia, Pa.
Birtman Electric Co., Chicago, Ill. "Bee."
Chicago Electric Vibrator Co., Chicago, Ill.
Clapp-Eastham Co., Cambridge, Mass.
Coates Clipper Mfg. Co., Worcester, Mass. "Rex," "Joy," "Giggie."
Crown Surgical Inst. Co., New York, N. Y.
Egan Electric Massage Vibratory Co., Petersburg, Ill.
Electric Mfg. Co., San Francisco, Calif.
Matthew Engeln Electric Co., Chicago, Ill.
Globe Mfg. Co., Battle Creek, Mich.
Golden Vibrator Co., San Francisco, Cal.
R. Haas Electric & Mfg. Co. Springfield, Ill. "Ideal."
Horn Electric Co., Chicago, Ill.
J. W. Hughes Co., New York, N. Y.
Illinois Appliance Co., Chicago, Ill. "Adaptable."
Keystone Elec. Co., Philadelphia.
Kny-Scheerer Co., New York, N. Y. (Physicians'.)
Lindstrom-Smith Co., Chicago, Ill. "White-Cross."
McIntosh Battery & Optical Co., Chicago, Ill.
Meyer Co., Wm., Chicago, Ill.
Monarch Vibrator Co., Jackson, Mich.
National Elec'l Mfg. Co., New York, N. Y.
Royal Specialty Co., Cleveland, O. "Royal," "Rex."
Shelton Elec. Co., New York.
Siebert-Welch Co., Massillon, O. "Insto."
Standard Electric Works, Racine Wis. "Arnold."
Stolz Electrophone Co., Chicago
Strand & Co., N. A., Chicago, Ill.
Swedish Elec. Vibrator Co.,Chicago, Ill.
Universal Novelty Co., New York, N. Y. "Vibrosimplex."
Vibrassage Co., Chicago, Ill.
Victor Electric Co., Chicago, Ill.
Waite & Bartlett Mfg. Co., New York. (Electro-Pneumatic.)
Wappler Elec. Mfg. Co., New York, N. Y.

VISES, Linemen's.
Mathias Klein & Sons, Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Dicke Tool Co., Downers Grove, Ill.

VOLTAGE REGULATORS.
See Regulators.

VOLTMETER SWITCHES.
See Switches.

VOLTMETERS.
See Ammeters.

VULCANIZERS, Electric.
Buffalo Electric Vulcanizer Co., Buffalo, N. Y.
Electric Vulcanizer Co., Minneapolis, Minn.
Gibney & Bros., James L., Philadelphia, Pa. ("Eleck-Trick.")
Shaler Co., C. A., Waupun, Wis.

WAGONS, Tower.
General Vehicle Co., Long Island City, N. Y. (Electric Hurry-Up Wagon.)
Leonhardt Wagon Mfg. Co., Baltimore, Md.
McCardell & Co., J. R., Trenton, N. J. "Trenton."
Milburn Wagon Co., Toledo, O

WASHERS, Clothes (Motor Driven).
Conlon Electric Washer Co., Chicago, Ill.
Federal Sign System (Electric), Chicago, Ill. "Federal."
Newton Washing Machine Co., Newton, Iowa.
American Washer Co., St. Louis, Mo. "Electric Star," "Jewell," "O-Joy."
Apex Appliance Co., Chicago, Ill.
Automatic Electric Washer Co., Newton, Iowa.
Beebe Co., E. F., Minneapolis.
Blackstone Mfg. Co., Jamestown, N. Y.
Combination Mfg. Co., Milwaukee, Wis. ("Ever Ready" and "Buster Brown.")
Conkling Co., Chicago, Ill.
Cycle Washing Machine Co., Chicago, Ill.
Darche Mfg. Co., Chicago, Ill.
Dietz Mfg. Co., John, Cincinnati, O. "Rub-board."
Dodge & Zuill, Syracuse, N. Y. ("Easy.")
Domestic Equipment Co., Chicago, Ill. "Oscillator," "Wizard."
Electric Motor Equipment Co., Denver, Colo.
Grinnell Washing Machine Co., Grinnell, Ia. "Elmo."
Horton Mfg. Co., Ft. Wayne, Ind.
Hurley Machine Co., Chicago, Ill. "Chicago", "Thor Electric".
Imperial Mfg. Co., Independence, Kans. (Washer & Wringer.)
Judd Laundry Machine Co., Chicago, Ill.
Keller Mfg. Co., Philadelphia, Pa. "Santo."
Maytag Co., Newton, Iowa.
National Laundry Machinery Co., Chicago, Ill.
National Motor Co, Springfield, Ohio.
Newton Washing Machine Co., Newton, Iowa.
Nineteen Hundred Washer Co., Binghamton, N. Y.
Paragon Mfg. Co., Chicago, Ill.
Rex Mfg. Co., Johnstown, Pa.
Rochester Rotary Washer Co., Rochester, N. Y.
Steiner Mfg. Co., St. Louis, Mo.
Thistle Mfg. Co., Chicago, Ill.
Universal Motor Co., Chicago, Ill.
Upton Machine Co., Benton Harbor, Mich.
Voss Bros. Mfg. Co., Davenport, Iowa.
White Lily Mfg. Co., Davenport, Iowa.

WASHERS, Dish (Motor Driven).
G. S. Blakelee & Co., Chicago, Ill.
Fearless Dishwasher Co, Rochester, N. Y.
Gairs-Cochrane Mfg. Co., Chicago, Ill.
Hamilton-Low Co., New York, N. Y. "Vortex."
Insinger Co., Philadelphia, Pa.
Weis Mfg. & Supply Co., Hammond, Ind.

WASHERS, Fibre.
See Fibre.

WASHERS, Garage.
(For Cleaning Automobiles.)
Coates Clipper Mfg. Co., Worcester, Mass.
Perfect Mfg. Co., Albany, N. Y.

WASHERS, Leather, Nail Insulating.
Eureka Supply Co., Sewell, N. J. (Fibre Insulators.)
Feeser Co., F. S., Indianapolis, Ind.
Fox & Co., John M., Portland, Me. "Fibrine."
Indiana Leather Stamping Co., Williamsport, Pa.
Planet Co., Westfield, Mass.

WASHERS, Spring.
(For Knife Switches.)
Wallace Barnes Co., Bristol, Conn.
Metal Products Corporation, Providence, R. I.

WATCH DEMAGNETIZERS.
See Demagnetizers.

WATCHMEN'S CLOCKS.
See Clocks.

WATER HEATERS.
See Heating Devices.

WATERPROOF FIXTURES.
See Marine.

WATER WHEELS.
See Turbines, Water.

WATT-HOUR METERS.
Bristol Company, Waterbury, Conn.
Duncan Electric Mfg. Co., Lafayette, Ind. "Monetary."
Fort Wayne Electric Works, Ft. Wayne, Ind.
General Electric Co., Schenectady, N. Y. ("Thomson" Integrating "Wright" Prepayment.)
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Mineralac Electric Co., Chicago, Ill. (Printing Attachments only.)
Sangamo Electric Co., Springfield, Ill.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Columbia Meter Co., Indianapolis, Ind.
Helios Mfg. Co., Philadelphia, Pa. ("Bastion" Electrolytic.)
Willis Electric Meter Co., Chicago.

WAX, Insulating and Sealing.
Mitchell-Rand Mfg. Co., New York, N. Y. (Sealing and Insulating Waxes.)
W. H. Bowdlear & Co., Boston, Mass.
Clark, Frank C., Chicago, Ill.
Cochrane Chemical Co., Jersey City, N. J. (Sealing Waxes.)
Hildreth & Segelken, New York, N. Y.
Insulatine Co., New York, N. Y. ("Gylte" Sealing and Insulating Waxes.)
Morningstar & Co., Charles, New York, N. Y. (Ceresine, Ozokerite and Sealing and Insulating Waxes.)
Smith & Nichols, New York, N. Y. (Ozokerite, Ceresine and Sealing and Insulating Waxes.)
Standard Oil Co., New York, N. Y. (Paraffine.)
Strohmeyer & Arpe Co., New York, N. Y. (Ozokerite, Ceresine, and Sealing and Insulating Waxes.)
Trotter & Co., E. T., Brooklyn, N. Y. (Insulating Waxes.)

WEBBING (For Tapes).
Belden Mfg. Co., Chicago, Ill.
Chicago Mica Co., Valparaiso, Ind.
Hope Webbing Co., Providence, R. I.
Smith Webbing Co., Pawtucket, R. I.

WEIGHTS, Telephone Cord.
K. & B. Co., Philadelphia, Pa.

WELDERS, Electric.
(Electric Welding Apparatus.)
Electric Controller & Mfg. Co., Cleveland, O.
Electric Ry. Improvement Co., Cleveland, O.
Garwood Electric Co., Garwood, N. J.
Lincoln Electric Co., Cleveland, Ohio.
National Electric Welder Co., Warren, Ohio.
Thomson Elec. Welding Co., Lynn, Mass.
Toledo Elec. Welder Co., Cincinnati, O.
Universal Elec. Welder Co., Long Island City, N. Y.

WELDING, Repair (Repairing Broken Forgings or Castings.)
Davis Bournonville Co., New York.
Michigan Elec. Welding Co., Detroit, Mich.

WHEATSTONE BRIDGES.
See Instruments.

WHISTLES, Automobile.
See Horns.

WHISTLES, Steam, Electrically Operated.
Gamewell Fire Alarm Telegraph Co., New York.
Garl Electric Co., Akron, O.
Lunkenheimer Co., Cincinnati, O.
Signal Control Co., New York, N. Y. (Electric Whistle Operator.)

WINDERS, Electro-Magnet.
Appleton Electric Co., Chicago, Ill.
Belden Mfg. Co., Chicago, Ill.
Hubbard & Co., Pittsburgh, Pa.
Harvard Electric Co., Chicago, Ill.
Universal Winding Co., Boston, Mass.

WINDING MACHINES.
See Machines.

WINDERS, Wire.
See Reels, Wire.

WINDLASSES, Arc Lamp.
Brady Electric Mfg. Co., New Britain, Conn.
Geo. Cutter Co., South Bend, Ind.
Ajax Line Material Works, South Milwaukee, Wis.
Ayer Mfg. Co., F. H., Chicago Heights, Ill.
Commercial Elec'l Supply Co., St. Louis, Mo. ("Eddy" Windlass.)
Creaghead Engrg. Co., Cincinnati, Ohio.
Fletcher Mfg. Co., Dayton, Ohio.
Fox-Multax Elec. Co., New York, N. Y. ("Positive Safety" Winch.)

WIRE, Aluminum.
Driver-Harris Wire Co., Harrison, N. J.

WIRE, Armature Banding.
American Electrical Works, Philipsdale, R. I.
American Steel & Wire Co., Chicago, Ill.
Belden Mfg. Co., Chicago, Ill.
Driver-Harris Wire Co., Harrison, N. J. "Hercules."
Roebling's Sons Co., J. A., Trenton, N. J.
Herman Boker & Co., New York, N. Y. (Importers.)
Washburn Wire Co., Phillipsdale, R. I.

WIRE, Asbestos Covered.
American Steel & Wire Co., Chicago, Ill.
Belden Mfg. Co., Chicago, Ill.
D & W Fuse Co., Providence, R. I. "Deltabesten."
H. W. Johns-Manville Co., New York, N. Y.
Standard Underground Cable Co., Pittsburgh, Pa.

WIRE, Bare Copper.
American Electrical Works, Philipsdale, R. I.
American Steel & Wire Co., Chicago, Ill.
Bridgeport Brass Co., Bridgeport, Conn. "Phono-Electric."
Driver-Harris Wire Co., Harrison, N. J.
Hazard Mfg. Co., Wilkes-Barre, Pa.
National Conduit & Cable Co., New York, N. Y.
Phillips Insulated Wire Co., Pawtucket, R. I.
John A. Roebling's Sons Co., Trenton, N. J.
Rome Wire Co., Rome, N. Y. "Romeoid."
Standard Underground Cable Co., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Ansonia Brass & Copper Co., New York, N. Y.
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Chicago Insulated Wire & Mfg. Co., Chicago, Ill.
Coe Brass Mfg. Co., Torrington, Conn.
Detroit Copper & Brass Rolling Mills, Detroit, Mich.
Hudson Wire Co., New York, N. Y. (Small Sizes.)
Murray Wire Co., Newark, N. J.
Spargo Wire Co., J. A., Rome, N. Y.
Waclark Wire Co., New York.

WIRE, Canvas Covered.
Ferrin, F. M. Boston, Mass.

WIRE CONNECTORS.
See Connectors.

WIRE, Copper Clad.
Standard Underground Cable Co., Pittsburgh, Pa. (Colonial.)
Duplex Metals Co., Chester, Pa. "Weld-Clad."
Paragon Sellers Co., Chicago, Ill. "Tronite."

WIRE, Enameled.
Belden Mfg. Co., Chicago, Ill. "Cottonamel," "Beldenamel."
General Electric Co., Schenectady.
Roebling's Sons Co., J. A., Trenton, N. J.

Western Electric Co., New York.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.
Acme Wire Co., New Haven, Conn. "Enamelite."
Automatic Electric Co., Chicago. "Raven."
Bradford, Kyle & Co., Plymouth, Mass.
Central Insulating Co., Lafayette, Ind.
Chicago Insulated Wire & Mfg. Co., Chicago.
Dudlo Mfg. Co., Fort Wayne, Ind.
Feval Enamel Insulated Wire Co., Chicago, Ill.
Massachusetts Elect. Mfg. Co., West Lynn, Mass.
Murray Wire Co., Newark, N. J.
Reliable Electric Co., Chicago, Ill.
Riege, Archer C., Frankford, Philadelphia, Pa.

WIRE, Fish.
Steel City Electric Co., Pittsburg, Pa. "Superior."
Cary Spring Works, New York.
Swan Electric Co., Boston.

WIRE, Galvanized Strand.
American Electrical Works, Philipsdale, R. I.
American Steel & Wire Co., Chicago, Ill.
Hazard Mfg. Co., Wilkesbarre, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Waterbury Co., New York, N. Y.
Broderick & Bascom Rope Co., St. Louis, Mo.
Leschen & Sons Rope Co., St. Louis, Mo.
Morgan Spring Co., Worcester, Mass.
Macomber & Whyte Rope Co., Chicago, Ill.
Williamsport Wire Rope Co., Williamsport, Pa.

WIRE, Gas Fixture.
American Electrical Works, Philipsdale, R. I.
Belden Mfg. Co., Chicago, Ill.
Moore, Alfred F., Philadelphia, Pa.

WIRE GAUGES.
See Gauges.

WIRE, Iron.
American Steel & Wire Co., Chicago, Ill.
Driver-Harris Wire Co., Harrison, N. J.
Hazard Mfg. Co., Wilkesbarre, Pa.
John A. Roebling's Sons Co., Trenton, N. J.
Crawfordsville Wire & Nail Co., Crawfordsville, Ind.
Indiana Steel & Wire Co., Muncie, Ind. "E. B. B.," "Steel," "B. B."
Morgan Spring Co., Worcester, Mass.
Shenandoah Steel Wire Co., Buffalo, N. Y.
Washburn Wire Co., Phillipsdale, R. I.

WIRE, Magnet.
American Electrical Works, Philipsdale, R. I.
Belden Mfg. Co., Chicago, Ill. "Cottonamel," "Silkenamel."
D & W Fuse Co., Providence, R. I. "Deltabeston."
Driver-Harris Wire Co., Harrison, N. J.
Hazard Mfg. Co., Wilkesbarre, Pa.
Moore, Alfred F., Philadelphia, Pa.
Roebling's Sons Co., J. A., Trenton, N. J.
Rome Wire Co., Rome, N. Y. "Romeoid."
Standard Underground Cable Co., Pittsburgh, Pa. "Green's Q. A." "Valtoy."
Western Electric Co., New York, N. Y. "Hawthorn."
Acme Wire Co., New Haven, Conn. "Enamelite," "Cottonite." "Silkenite."
Ansonia Electrical Co., Ansonia, Conn.
Automatic Electric Co., Chicago, Ill.
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Bradford, Kyle & Co., Plymouth, Mass.
Chicago Insulated Wire & Mfg. Co., Chicago, Ill.
Feval Enameled Insulated Wire Co., Chicago, Ill.
Goldmark Co., James, New York, N. Y. (Sole Selling Agent New England Electric Works, Lisbon, N. H.)
McEvoy, C. H., Lowell, Mass.
Massachusetts Electric Mfg. Co., West Lynn, Mass.
Riege, Archer C., Philadelphia, Pa.
Rome Electrical Co., Rome, N. Y.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Stuart - Howland Co., Boston, Mass. (Sole Selling Agents for Standard Magnet Wire Co., Claremont, N. H.)

WIRE, Phosphor Bronze.
Driver-Harris Wire Co., Harrison, N. J.
Electrical Alloy Co., Morristown, N. J.
Standard Underground Cable Co., Pittsburgh, Pa.
Bradford, Kyle & Co., Plymouth, Mass.
Murray Wire Co., Newark, N. J.
Phosphor-Bronze Smelting Co., Philadelpjhia, Pa. "Elephant."
P. S. Reeves & Son, Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Waterbury Mfg. Co., Waterbury, Conn.

WIRE, Resistance.
(See Resistance)

WIRE, Rubber Covered. Rubber Covered Wire, Rubber Covered Cables, Flexible Cord, Annunciator Wire, Office Wire.
American Electrical Works, Philipsdale, R. I. "Americanite."
American Steel & Wire Co., Chicago, Ill. "Crown," "W. & M.," "Globe."
Atlantic Insulated Wire & Cable Co., New York, N. Y. "Neptune," "Dolphin," "Triton," "Beacon."
Belden Mfg. Co., Chicago, Ill.
Detroit Insulated Wire Co., Detroit, Mich.
B. F. Goodrich Co., Akron, O. "Diamond N. E. Code," "Diamond Special 30 per cent." "Diamond L." "Diamond 30 per cent Para."
Driver-Harris Mfg. Co., Harrison, N. J. (Flexible Cord.)
Electric Cable Co., Bridgeport, Conn.
General Electric Co., Schenectady.
Habirshaw Wire Co., New York, N. Y. "Attix."
Hazard Mfg. Co., Wilkes-Barre, Pa. "Penn New Code," "Hazard High Grade," "Hazard 30% Para."
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. "Peerless," "Paranite."
Kerite Insulated Wire & Cable Co., New York, N. Y.
Lowell Insulated Wire Co., Lowell, Mass.
Marion Insulated Wire & Rubber Co., Marion, Ind. "Eagle."
Moore, Alfred F., Philadelphia.
National Conduit & Cable Co., New York.
National India Rubber Co., New York, N. Y.
New York Insulated Wire Co., New York, N. Y. "Raven Core," "Grimshaw White Core."
Okonite Co., New York, N. Y.
Phillips Insulated Wire Co., Pawtucket, R. I. "Parac."
John A. Roebling's Sons Co., Trenton, N. J.
Rome Wire Co., Rome, N. Y. "Romeoid."
Safety Insulated Wire & Cable Co. of New Jersey, New York.
Simplex Wire & Cable Co., Boston, Mass. "Simcore," "Simplex Caoutchouc" (Simplex "B. C.").
Sprague Electric Works, New York, N. Y. ("Greenfield" Steel Armored Flexible Cord.)
Standard Underground Cable Co., Pittsburgh, Pa. "Tip - Top," "Marsh," "Sterling."
Waterbury Co., New York, N. Y. "Red W."
Western Electric Co., New York.
Acme Rubber Mfg. Co., Trenton, N. J.
American Electrical Heater Co., Detroit, Mich. (Flexible Heater Cord.)
Ansonia Elec'l Co., Ansonia, Conn.
Bay State Insulated Wire & Cable Co., Hyde Park, Mass. "Maconite."
Benedict & Burnham Mfg. Co., Waterbury, Conn.
Bishop Gutta Percha Co., New York. "Parayel," ("Cremfield" Cord), "Balata."
Boston Insulated Wire & Cable Co., Boston, Mass.
Bourn Rubber Co., Providence, R. I. "Star."
Canadian General Electric Co., Toronto, Ont.
Chicago Insulated Wire & Mfg. Co., Chicago, Ill.
Collyer Insulated Wire Co., Pawtucket, R. I. "I. X. L."
Consumers' Rubber Co., Bristol, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J. "Imperial"
Duplex Metals Co., New York, N. Y., "Weld-Clad."
Ferrin, F. M., Boston, Mass. (Canvas Covered.)
Goodyear Rubber Insulating Co., New York.
Home Rubber Co., Trenton, N. J.
McEvoy, C. H., Lowell, Mass.
Monarch Electric & Wire Co., Chicago, Ill.
Montgomery Co., J. R., Windsor Locks, Conn. ("Electric Thread" for Switchboard Cord.)
Paragon-Sellers Co., Chicago, Ill. "Ironite" (for Telephone Taps).
Premier Electric Co., Chicago, Ill. (Flexible Cord.)
Runzel-Lenz Elec. Mfg. Co., Chicago, Ill. (Flexible Cord.)
Wire & Cable Co., Montreal, Canada.

WIRE SCRAPERS.
See Tools, Linemen's.

WIRE STRAIGHTENERS.
See Straighteners, Wire.

WIRE STRETCHERS.
See Comealongs.

WIRE, Weatherproof.
American Electrical Works, Philipsdale, R. I. "Star."
American Insulated Wire & Cable Co., Chicago, Ill.
American Steel & Wire Co., Chicago, Ill. "Reliance."
General Electric Co., Schenectady.
Hazard Mfg. Co., Wilkes-Barre, Pa.
Moore, Alfred E., Philadelphia.
National Conduit & Cable Co., New York, N. Y.
Okonite Co., New York, N. Y. "Candee."
Phillips Insulated Wire Co., Pawtucket, R. I. "O. K."
Roebling's Sons Co., J. A., Trenton, N. J.
Rome Wire Co., Rome, N. Y. "Romeoid."
Simplex Wire & Cable Co., Boston, Mass. "Simcore," "Simplex Caoutchouc" (Simplex "B. C.")
Standard Underground Cable Co., Pittsburgh, Pa. "Tip - Top," "Marsh," "Sterling."
Western Electric Co., New York.
Ansonia Electrical Co., Ansonia, Conn. "Shield."
Benedict & Burnham Mfg. Co., Waterbury, Conn. "K. K."
Chicago Insulated Wire & Mfg. Co., Chicago, Ill.
Collyer Insulated Wire Co., Pawtucket, R. I. "New Code," "I. X. L."
Dielectric Co. of America; Belleville, N. J. "D. E."
Duplex Metals Co., New York, N. Y. "Weld-Clad."
McEvoy, C. H., Lowell, Mass.
Monarch Electric & Wire Co., Chicago, Ill.
Sterling Insulated Wire Co., Chicago, Ill.
Waclark Wire Co., New York.

WIRELESS APPARATUS.
Manhattan Electrical Supply Co., New York, N. Y.
Alden Wireless Co., Campello, Mass.
Clapp-Eastman Co., Cambridge, Mass.
Geo. W. Conner, Malden, Mass.
Dawson & Winger Electric Co., Chicago, Ill.
Electro Importing Co., New York.
Etheric Electric Co., New York.
I. W. T. Wireless Co., Brooklyn, N. Y.
International Wireless Co., Lima, Ohio. (Experimental Outfit.)
Marconi Wireless Tel. Co., New York, N. Y.
Mecograph Co., Cleveland, Ohio. (Transmitters.)
Wm. J. Murdock Co., Chelsea, Mass.
B. M. Myers Electrical House, Evansville, Wis. (Experimental Outfits.)
Queen-Gray Co., Philadelphia, Pa.
E. S. Ritchie & Sons, Brookline, Mass.
Roentgen Mfg. Co., Philadelphia, Pa.
Standard Wireless Equipment Co., Los Angeles, Cal.
Thomas St. John, New York, N. Y.
C. H. Stoelting Co., Chicago, Ill.
Telefunken Wireless Telegraph Co., New York, N. Y.
Toledo Wireless Co., Toledo, Ohio.
Wappler Electric Mfg. Co., New York, N. Y.
Wireless Specialty Apparatus Co., New York.
Worts-McKisson Mfg. Co., Toledo, Ohio. "W.-M."

WOOD FIXTURES.
See Fixtures, Wooden.

WRAPPERS, Tungsten Lamp.
See Boxes.

WRAPPERS, Conduit Joint.
Philadelphia Electrical & Mfg. Co., Philadelphia, Pa.

WRENCHES.
Klein & Sons, Mathias, Chicago, Ill. (Lag Screw, Tie and Splicing.)
Smith & Hemenway Co., New York.
Tudor Mfg. Co., Taunton, Mass. ("Bay State" Cross Arm.)
Yost Electric Mfg. Co., Toledo, O. "Falcon" (Fixture Wrenches.)

X-RAY OUTFITS, Fluoroscopes, Crookes Tubes.
Campbell Electric Co., Lynn, Mass.
Anderson, Norden & Co., Chicago, Ill. "Nelson."
Baker Electric Co., Hartford, Conn.
Birtman Electric Co., Chicago, Ill.
Clapp-Eastham Co., Boston, Mass. ("Ceco" and "Quality" Coils.)
Electric Mfg. Co., San Francisco, Calif.
Electro Importing Co., New York.
Engeln & Co., H. P., Cleveland, O.
Matthew Engeln Elec. Co., Chicago, Ill.
Foote, Pierson & Co., New York.
Jackson, F. E., Orange, N. J.
Kelley-Koett Mfg. Co., Covington, Ky. "Grosse Flamme" (Coil).
Keystone Electric Co., Philadelphia, Pa.
Kny-Scheerer Co., New York.
Lamont, G. E., San Francisco, Calif.
Macalaster-Wiggin Co., Boston, Mass.
Meyer Co., Wm., Chicago, Ill.
Prague Electric Co., Providence, R. I.
Queen-Gray Co., Philadelphia, Pa.
Roentgen Mfg. Co., Philadelphia, Pa.
Scheidel-Western X-Ray Co., Chicago, Ill.
Seely Mfg. Co., Pittsburgh, Pa.
Sirch Electrical and Testing Laboratories, Los Angeles, Calif.
Thordarson Elec. Mfg. Co., Chicago, Ill.
Todd, Henry B., Meriden, Conn.
Waite & Bartlett Mfg. Co., New York.
Wappler Elec. Mfg. Co., New York, N. Y.
Williams, E. Q., Syracuse, N. Y.

YARN AND THREAD, Silk Cotton.
H. W. Johns-Manville Co., New York.
Samson Cordage Works, Boston, Mass.
Belding Bros. & Co., Chicago, Ill.
Boston Braid Mfg. Co., Boston, Mass.
Chelsea Fibre Mills, New York.
Eureka Silk Mfg. Co., Boston, Mass.
Florence Thread Co., Florence, N. J.
Malcolm Mills Co., Philadelphia, Pa.
Planet Mills Mfg. Co., Brooklyn, N. Y.
Ryle & Co., Wm., New York, N. Y.
Sauquoit Silk Mfg. Co., Philadelphia, Pa.
Warren Thread Works, W., Westfield, Mass.

ZINCS, Battery.
Manhattan Electrical Supply Co., New York.
Beattie Zinc Works Co., Reading, Mass.
Brady Brass Co., Jersey City, N. J.
Bryant Mfg. Co., Chicago, Ill.
Bryant Zinc Co., Chicago, Ill.
J. H. Bunnell & Co., New York.
Edes Mfg. Co., Plymouth, Mass.
Electric Goods Mfg. Co., Canton, Mass.
Grasselli Chemical Co., Cleveland, O. "Franklin."
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
Pacific Metal Works, San Francisco, Calif.
Pearce Co., Frederick, N. Y.
Prescott & Son, J. B., Webster, Mass.
Railroad Supply Co., Chicago.

ALPHABETICAL INDEX TO ADVERTISEMENTS

A

Aetna Electric Co. 26
Adam Electric Co., Frank.... 4
Adapti Mfg. Co. 11
Allis-Chalmers Mfg. Co. 2
American Bridge Co. 87
American Conduit Co. 8
American Conduit Mfg. Co...104
American District Steam Co.. 91
American Electrical Works...104
American Insulated Wire & Cable Co. 17
American Sheet & Tin Plate Co. 14
American Steel & Wire Co.... 17
Anderson Mfg. Co., Albert & J. M. 22
Any Lite Incandescent Lamp Regulator Co. 28
Arnold Co. 91
Arrow Electric Co. 1, 5
Atlantic Insulated Wire & Cable Co. 18

B

Babcock & Wilcox Co. 89
Badt-Westburg Electric Co.... 91
Baker & Co., Inc. 100
Beardslee Chandelier Mfg. Co. 28
Beck Electric Construction Kompany 91
Beers Sales Co. 30
Belden Manufacturing Co.... 18
Benjamin Electric Mfg. Co... 25
Blake Signal & Mfg. Co. 6
Borden Co. 8
Brady Electric Mfg. Co. 101
Bridgeport Brass Co. 104
Bristol Co. 104
Burniey Battery & Mfg. Co.. 20
Byllesby & Co., H. M. 91

C

Camp Co., H. B. 9
Carbolineum Wood Preserving Co. 101
Carney Co., B. J. 101
Central Electric Co. 20
Central Station Engineering Co. 91
Central Telephone & Electric Co. 87
Century Electric Co. 97
Chelton Electric Co. 10
Chicago Fuse Mfg. Co. 12, 20
Chicago Glass Novelty Co.... 26
Chicago Mica Co. 14
Clifton Mfg. Co. 20
Columbia Metal Box Co. 10
Commonwealth Edison Co..14, 89
Continental Hotel 30
Cook Pottery Co. 4
Crawford Cedar Co. 101
Crocker-Wheeler Co. 96
Cutler-Hammer Mfg. Co. 94
Cutter Co. 96

D

Dearborn Chemical Co. 89
Detroit Insulated Wire Co....104
Dixon Crucible Co., Joseph.... 96
Dixon-Smith Engineering Co.. 91
Driver-Harris Wire Co. 16
Duluth Log Co. 100
Duncan Electric Mfg. Co. 3
D & W Fuse Co. 20

E

Eck Dynamo & Motor Co.... 97
Economy Fuse & Mfg. Co.... 6
Edison Lamp Works of General Electric Co. 33
Edison Storage Battery Co..901A
Electrical Engineers Equipment Co. 3
Electrical Testing Laboratories 22
Electric Appliance Co. 31
Electric Bond & Share Co.... 89
Electric Cable Co. 104
Electric Controller & Mfg. Co. 95
Electric Machinery Co. 97
Electric Storage Battery Co.. 7
Emerson Electric Mfg. Co.... 97
Enameled Metals Co. 9

F

Findlay Electric Porcelain Co. 10
Flour City Ornamental Iron Works 24
Ford, Bacon & Davis. 91
Fort Wayne Electric Works.. 93

G

General Electric Co. 34, 35, 36, 37
General Vehicle Co. 899A
Gest, G. M. 9
Gill & Co., Inc. 27
Goettman, O. J. 87
Goodrich Co., B. F. 18
Gould Storage Battery Co..903A
Graner - Mahoney Contracting Co. 14
Gregory Electric Co. 89

H

Hart Mfg. Co. 21
Hartford Time Switch Co.... 21
Hazard Mfg. Co. 16
Help Wanted 88
Hemingray Glass Co. 100
Hemming Mfg. Co. 13
Holophone Co. 27
Hotel Imperial 20
Hoyt Electric Instrument Works 92
Humphrey, C. W. 91

I

Independent Lamp & Wire Co. 18
Indiana Rubber & Ins. Wire Co. 38

J

Jackson, D. C. & Wm. B.... 91
Jeandron, W. J. 98
Jordan Bros., Inc. 8

K

Kellogg Switchboard & Supply Co. 18
Kerite Ins. Wire & Cable Co..104
King Foundry Co. 24
Klein & Sons, Mathias 21
Kliegl Bros. 28
Koerting & Mathiesen Co..... 29

L

Leclanche Battery Co. 88
Leeds & Northrup Co. 92
LeValley Vitae Carbon Brush Co. 98
Light & Development Co. of St. Louis 91
Line Material Co. 23
Lindsley Bros. Co. 101
Lloyd-Thomas Co. 91
Lowell Insulated Wire Co.... 16
Lux Manufacturing Co. 30
Lyndon, Lamar 91

M

Manhattan Electrical Supply Co. 6
Marion Insulated Wire & Rubber Co. 104
Matthews & Bro., W. N. 15
McGill Mfg. Co. 28
McLennan Co., K. 88
McMeen, Samuel G. 91
McRoy Clay Works. 9
Meyers Mfg. Co., Fred J. 24
Miller, Kempster B. 91
Minneapolis Electric & Construction Co. 100
Miscellaneous 88
Moore, Alfred F. 16
Morgan Crucible Co., Ltd.... 98
Morse Twist Drill & Machine Co. 96
Multi Refillable Fuse Co. 30
Munsell & Co., Eugene. 4

N

National Carbon Co. 26
National Conduit & Cable Co. 16
National India Rubber Co.... 20
National Metal Molding Co... 6
National Pole Co. 100
Naugle Pole & Tie Co. 101
New England Butt Co. 16
New York Incandescent Lamp Co. 24
New York Insulated Wire Co..104
Nungesser Carbon & Battery Co. 96

O

Okonite Co. 38, 104
Ostrander & Co., W. R. 100

P

Packard Electric Co. 31
Page & Hill Co. 101
Paiste Co., H. T. 4
Partridge Lumber Co., T. M..100
Pass & Seymour, Inc. 7
Peerless Electric Co. 97
Phillips Insulated Wire Co....104
Phoenix Glass Co. 27
Pillsbury, Charles L. 91
Positions Wanted 33
P. R. Mfg. Co. 14
Pyrene Mfg. Co. 21

R

Rail Joint Co. 89
Reisinger, Hugo 29
Ridgway Dynamo & Engine Co. 89
Rittenhouse Co., A. E. 29
Roebling's Sons Co., John A... 16
Rome Wire Co. 104

S

Safety Insulated Wire & Cable Co. 19
Samson Cordage Works. 87
Sandpoint Lumber & Pole Co., Ltd. 101
Sargent & Lundy 91
Schott Co., W. H. 91
Schwarze Electric Co. 14
Scranton Button Co. 12
Sessions, E. O. 91
Sherwin-Williams Co. 12
Siggers, E. G. 38
Simplex Electric Heating Co.. 7
Simplex Wire & Cable Co.... 19
Smith & Hemenway Co. 87
Sprague Electric Works. 17
Standard Paint Co. 4
Standard Underground Cable Co. 3
States Co., The 87
Sterling & Son Co., W. C....101
Stone & Webster Eng. Corp.. 91
Sundh Electric Co. 28

T

Thomas & Betts Co. 8
Torrey Cedar Co. 101
Triumph Electric Co. 97
Trumbull Electric Mfg. Co... 7
Tubular Woven Fabric Co.... 9

U

Underwriters' Laboratories, Inc. 91
Union Electric Co. 4
Universal Electrical Stage Lighting Co. 28
U. S. E. M. Co. 4
U. S. Light & Heating Co.... 12

V

Valentine-Clark Co. 101
Viking Electric Co. 22

W

Wagner Electric Mfg. Co.... 98
Want Advertisements 88
Western Electric Co. 32
Westinghouse Elec. & Mfg. Co. 99, 102
Westinghouse Machine Co....103
Weston Elec. Instrument Co.. 38
White Companies, J. G. 91
Willard Storage Battery Co... 4
Wirt Co. 26
Woodmansee & Davidson, Inc. 91

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Send this to us with $1.50 and we will deliver to your nearest express office. *Ask about our 3,000 R. D. Tools.*

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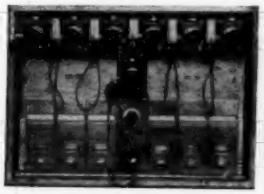

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St. Louis, Mo., Third Nat'l Bank Building
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Salt Lake City, Utah, Walker Bank Building
Duluth, Minn. . . . . Wolvin Building
Minneapolis, Minn., 7th Ave. & 2d St., S. E.

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U. S. Steel Products Co., Pacific Coast Dpt.
SAN FRANCISCO, CAL., Rialto Building
Portland, Ore. . . . . Selling Building
Seattle, Wash., 4th Ave. So., Cor. Conn. St.

Export Representative: United States Steel Products Co., 30 Church St., N. Y.

ELECTRICAL EXCHANGE

POSITIONS WANTED

The rate for "Positions Wanted" advertisements is two cents per word, minimum charge 50 cents an insertion, payable in advance. Remittances and copy should reach this office not later than Monday 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

POSITION WANTED—As power and light salesman by technical man with ten years commercial experience in the employ of large and well established contracting, engineering and manufacturing corporations; particularly familiar with motor and control application; has knowledge of power rates, load factors and transmission. At present employed by one of the big companies. Age 34, married, will go anywhere. Can arrange for change in a reasonable time. Not interested in any minor position or offer without merit. Address No. 1652, Electrical Review and Western Electrician, Chicago.

POSITION WANTED—By experienced electrician, with some money to invest in an up-to-date electrical contracting company. Location west of Mississippi river preferred. Correspondence invited. Address, No. 1656, Electrical Review & Western Electrician, Chicago.

POSITION WANTED—By young married man to handle engineering and sales of switchboards and panelboards, exceptionally familiar with detail design and manufacturing; especially well equipped with data and prices to estimate rapidly and accurately. Sixteen years technical and commercial training in the electrical business. At present employed in this line. Interested only in first-class propositions. Address No. 1651, Electrical Review and Western Electrician, Chicago.

POSITION WANTED—To experiment black enamel insulated wire with some firm that is making, or that is interested in making, black enamel insulated wire. I have six years' experience and have been experimenting for one year and find I can make great success. For further information address No. 1654, Electrical Review and Western Electrician, Chicago.

POSITION WANTED—Supervising construction or maintenance of D. C. or A. C. plant by practical electrical mechanical engineer. 15 years' experience in the field. Habits and references first class. Married. Have lost only three days in past three years. Two weeks' notice required. State requirements fully. Address, No. 1646, Electrical Review and Western Electrician, Chicago.

HELP WANTED

The rate for "Help Wanted" advertisements is three cents a word, minimum charge $1.50 an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

WANTED—Salesman for New York and Pennsylvania to sell Bare and Insulated Copper Wire and light steel specialties. State experience salary and references. Address, No. 1660, Electrical Review and Western Electrician, Chicago.

WANTED—Salesmen. Several high grade, responsible men who are producers for permanent, good paying positions selling patented incandescent lamps. Should be familiar with lamps or electrical supply lines. Give experience, salary expected and references. Excellent opportunities for advancement. Address, No. 1659, Electrical Review and Western Electrician, Chicago.

WANTED—Battery Foreman, man capable of organizing and handling the manufacturing end in small concern in large city, middle west, manufacturing primary batteries; must be familiar with copper oxide plate manufacturing. Address, giving experience and salary desired to No. 1661, Electrical Review and Western Electrician, Chicago.

WANTED—An all-around lineman and trouble man, who is accustomed to locate light and motor troubles. A married man preferred, and one who wishes a permanent position. Give age, experience and salary wanted. Marquette County Gas & Electric Co., Ishpeming, Mich.

WANTED—Winder on small induction type motors; one who can design forms for rapid production of form wound stators. State past experience and salary expected. Address, No. 1657, Electrical Review and Western Electrician, Chicago.

WANTED—Active agents in Boston, Pittsburgh, Buffalo, Philadelphia, Atlanta, Dallas, St. Paul, San Francisco, St. Louis. Best refillable fuse proposition out. Send references and sales connection. A good line for progressive jobbers to handle. Multi-Refillable Fuse Co., 817 Washington Blvd., Chicago.

WANTED—Ignition Engineer, experienced in the design and manufacture of Battery Ignition Apparatus, wanted to take charge of Ignition Department of large electrical manufacturing company. In answering state age, education, experience and salary desired. Address, No. 1642, Electrical Review and Western Electrician, Chicago.

MISCELLANEOUS

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Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

MONEY MAKING CHANCE—for central stations having high tension systems. I have available complete engineering data, including prices, drawings, etc., of low priced high tension weatherproof outdoor substations. Write for details. Address No. 1635, Electrical Review and Western Electrician, Chicago.

WANTED—Copper Oxide Plates. Quantity of materials for making copper oxide primary battery plates. Will also buy patents on new primary batteries, also want glass jars. Address No. 1662, Electrical Review and Western Electrician, Chicago.

WANTED—Lighting Plant. Practical Central Station parties desire information on a good lighting plant in live town of Two to Five Thousand, located in central states where fuel may be obtained reasonably. Must have long term franchise. Parties desiring to sell give location and full information in first letter. Address, No. 1658, Electrical Review and Western Electrician, Chicago.

PROPOSALS

The rate for "Proposal" advertisements is fifteen cents per line, nonpareil measurement, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., October 13, 1913.—Sealed proposals will be received at this office until 3 p. m. November 3, 1913, and then opened, for the removal of the present elevator and installation complete of an electric passenger elevator in the United States courthouse, post office, etc., at Wichita, Kans., in accordance with the drawing and specification, copies of which may be had at this office in the discretion of the Supervising Architect. O. Wenderoth, Supervising Architect.

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Benjamin H. Glover....805
Electric Heating Apparatus....806
Operation of the Wireless Law....806
International Commission's Rating of Electrical Machinery....806
Electricity in Harness Manufacturing....807
Data on City Water Pumping....812
Central-Station Power for Ice-Making and Refrigeration..812
Slogan Sign for Little Rock....813
Gas and Electric Company Wins First Prize....813
Installation of Rigid-Conduit Work in Buildings of Concrete Construction—III—By G. N. McCarthy....814
Control of Electrical Installation by the Municipality....816
Electrical Construction for the Panama-Pacific Exposition.818
The Electric Railway Associations' Conventions....825
The New York Electrical Show....827
Coal and Ash-Handling Equipment at Pacific Mills Print Works....832
Annual Convention of the Telephone Pioneers of America.834
Electrical Census Figures for 1909....838
Convention of Association of Railway Electrical Engineers....838

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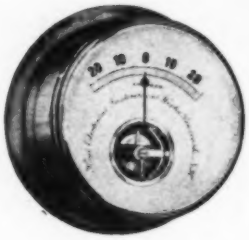

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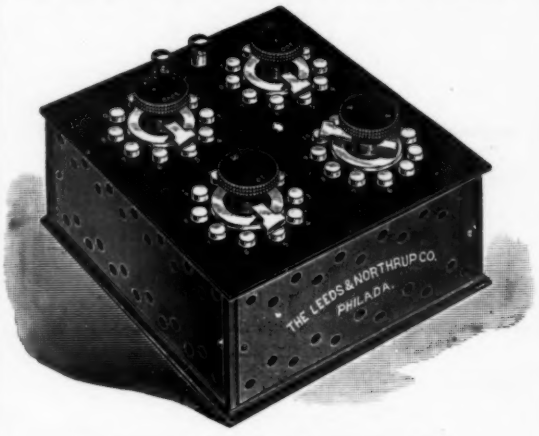

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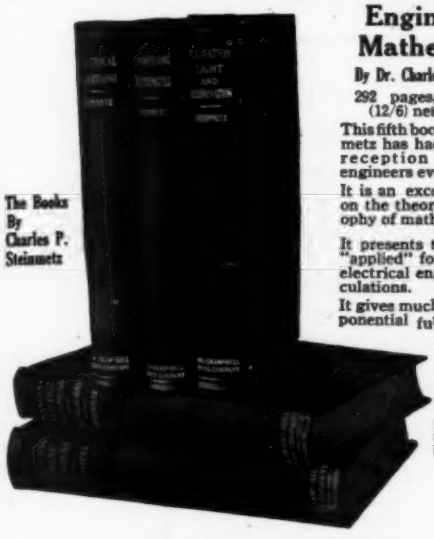

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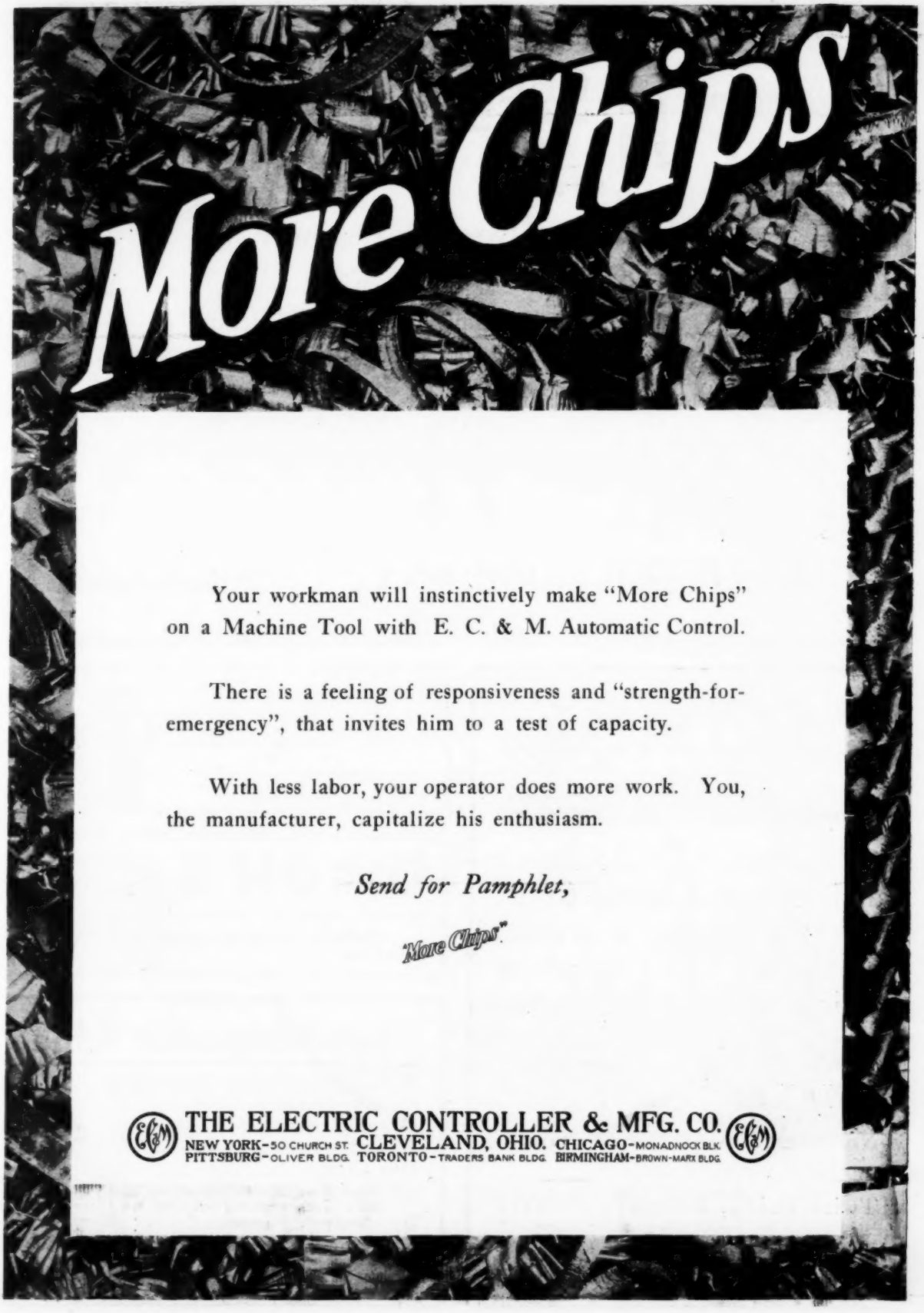

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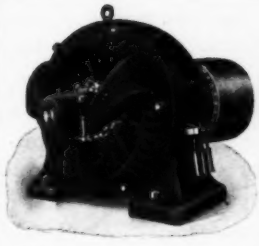

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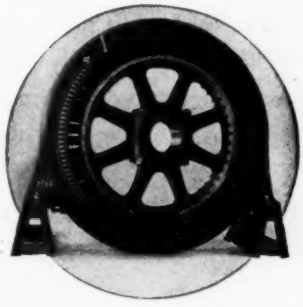

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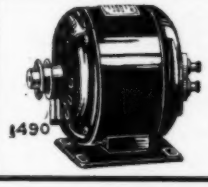

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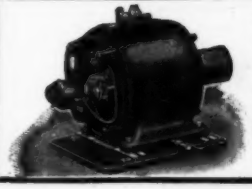

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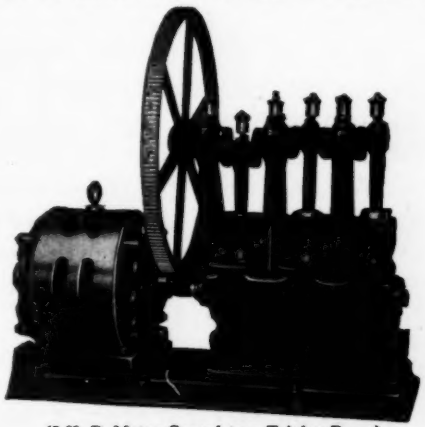

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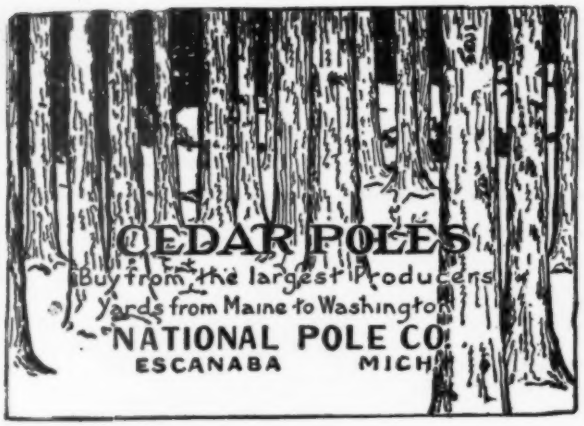

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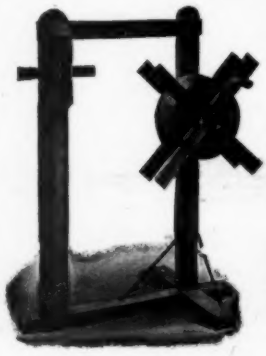

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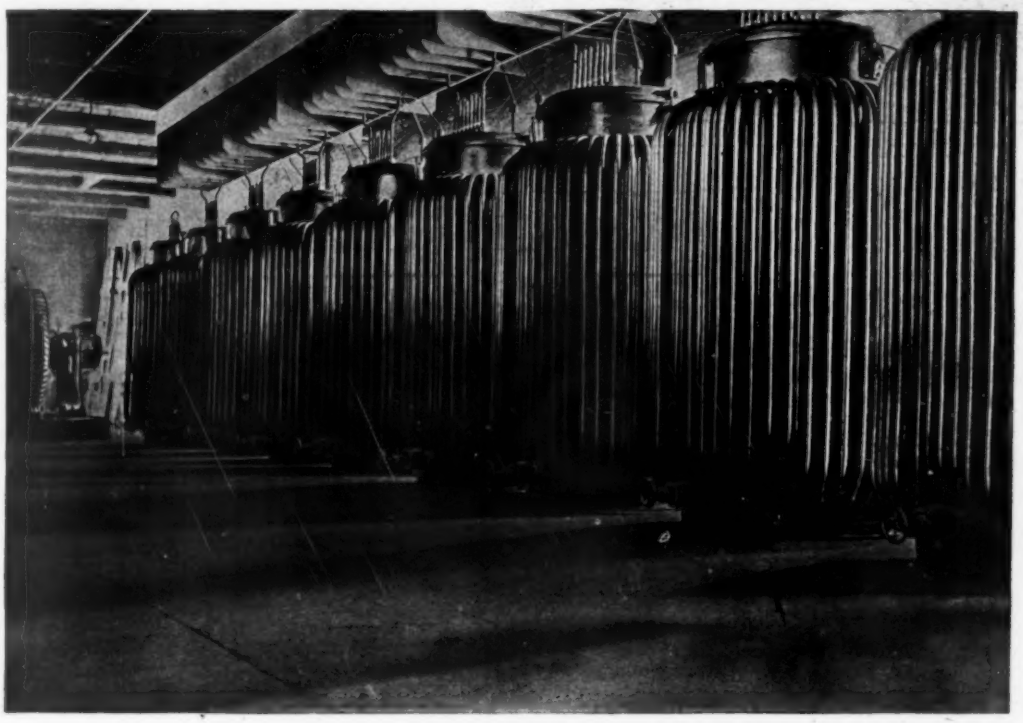

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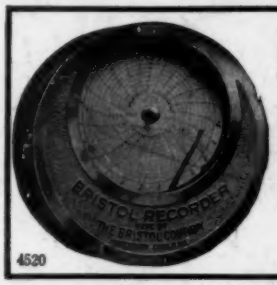

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